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AMERICAN INDUSTRIES.—No. 61.

THE MANUFACTURE OF STEAM APPLIANCES.

About a quarter of a century ago the accessories of steam boilers and engines were few and very crude, and little reliance could be placed on them; but within the last twenty-five years great strides have been made in improving and perfecting these articles. There are many patents for improvements and so-called improvements, but those of real merit are comparatively few. Among the prominent improvements which have proved their superiority by practical tests are those invented by George H. Crosby, the well known inventor of steam appliances.

The Crosby patents are owned and manufactured exclusively by the Crosby Steam Gage and Valve Company, of Boston. The career of this company, although by no means long, has been one of unprecedented success; this is mainly attributable to the merits of their products.

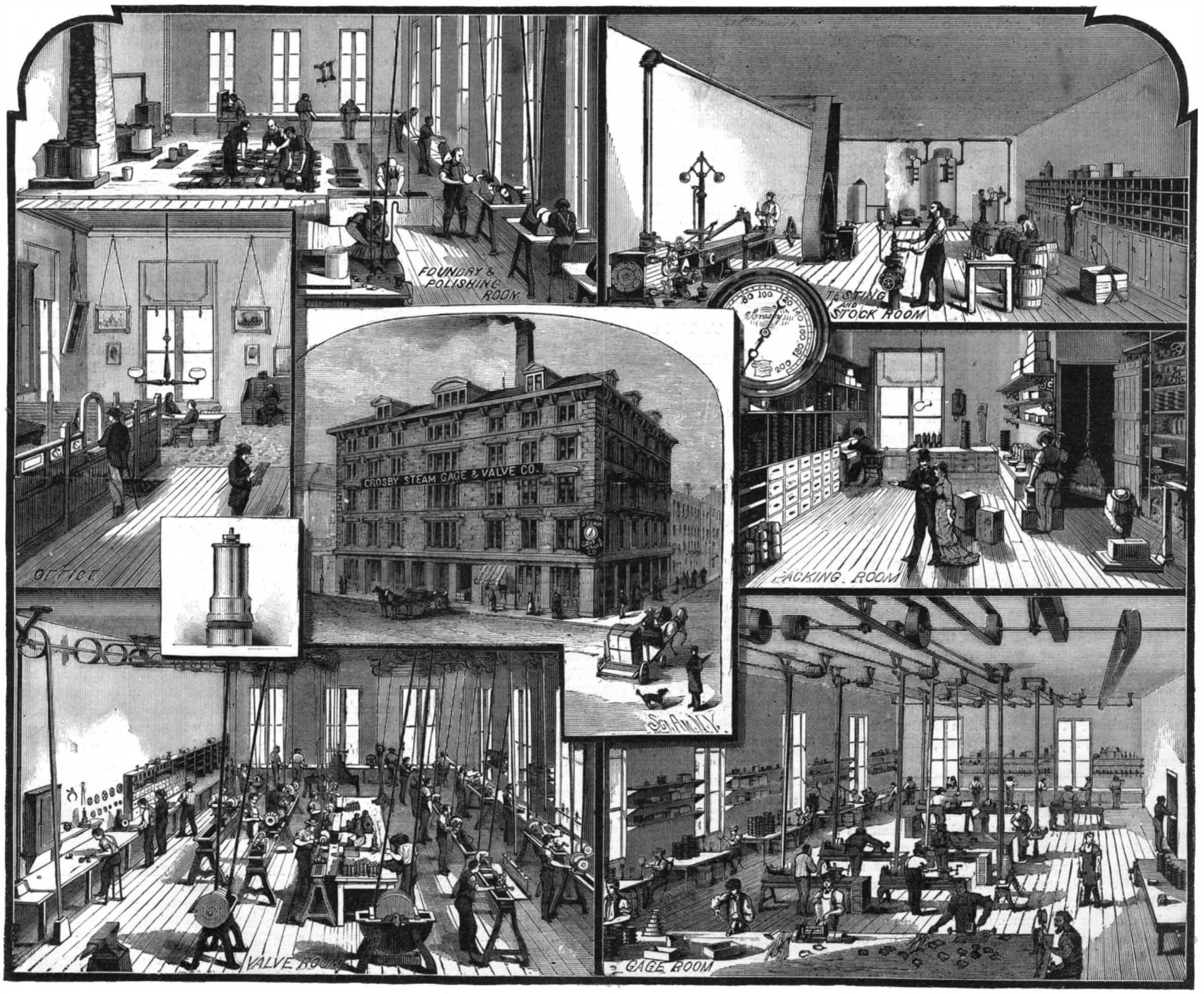
There is no class of instruments in use that require more ingenuity in design, care in manufacture, or accuracy in adjustment than those for indicating, measuring, and regulating the pressure of steam. Mr. Crosby, who is an experienced inventor in this class of instruments, and also a thoroughly practical mechanic, has been actively engaged in the business since boyhood, and gives his personal attention and supervision to the construction of all goods made in this establishment, conducting operations in a uniform and systematic manner, besides being constantly engaged in inventing new machines and improving those already in existence.

This company, full of energy and enterprise, has thoroughly introduced its goods and established a good reputation throughout this and foreign countries. Its success, considering that the business was started in 1875, when manufacturing was at its lowest, is remarkable. Its sales have steadily increased from year to year, consequently its manufacturing facilities have of necessity been correspondingly augmented by the addition of new and improved machinery, until a workman can now accomplish as much in one day as he formerly could in two. It is impossible for us in a necessarily condensed article like this to do justice to this establishment or the ingenuity and workmanship displayed in its products; it will suffice to give a short description of the prominent specialties which have been thoroughly tested and stand unexcelled.

The principle of the hollow elastic metal spring invented by Eugene Bourdon, of France, having been conceded to be the best upon which to construct pressure gages for durability, sensitiveness, and accuracy, was adopted; but the Bourdon gage as originally designed was only adapted for registering low pressure and vacuum, and it is still made by this company for these purposes. The Crosby improved Bourdon pressure gage is designed especially for high pressures, and does not possess the defects of the original Bourdon. By the peculiar shape and arrangement of the springs and the novel transmitting mechanism all the motion of the free ends of the springs is utilized, permitting the use of springs a hundred per cent stronger for the same pressures than can be used in any other gage, removing all danger of setting under any pressure indicated upon its dial, and preventing any undue oscillation of the pointer. At the same time water in the tubes can return to the boiler as fast as it accumulates, thus preventing freezing during extreme cold. This gage has been generally adopted by railroads, builders of locomotives, portable and steam fire engines, and wherever high pressure is required. Gages are also made upon this principle for water works, with dials graduated for pressure per square inch and height of water in column; and for hydrostatic presses and hydraulic rams graduated for pounds per square inch and tons on ram. Various other combinations are made, such as pressure and temperature of steam, etc.

The Crosby adjustable pop safety valve has won for itself a reputation that reflects credit upon its inventor and manufacturers. Thousands are sold annually, and at the present time there is scarcely a railroad or builder of any class of engines that are not using or adopting them. This is a safety valve which is all its name implies, is automatic, certain in its action, prompt in opening and closing at the required points of pressure, and, we are assured, can be fully relied upon to relieve the boiler under all circumstances. The amount of reduction of pressure when open can be varied at will while under steam, from one pound to one quarter the pressure at point of opening. It is simple and durable, remaining, with fair usage, for years without deteriorating. They are made to correspond with the requirements, and are used on locomotive, portable, steamboat, stationary, and steam fire engine boilers, and for other purposes.

The Crosby self-regulating reducing valve was produced



THE MANUFACTURE OF STEAM APPLIANCES.—CROSBY STEAM GAGE AND VALVE COMPANY, BOSTON, MASS.

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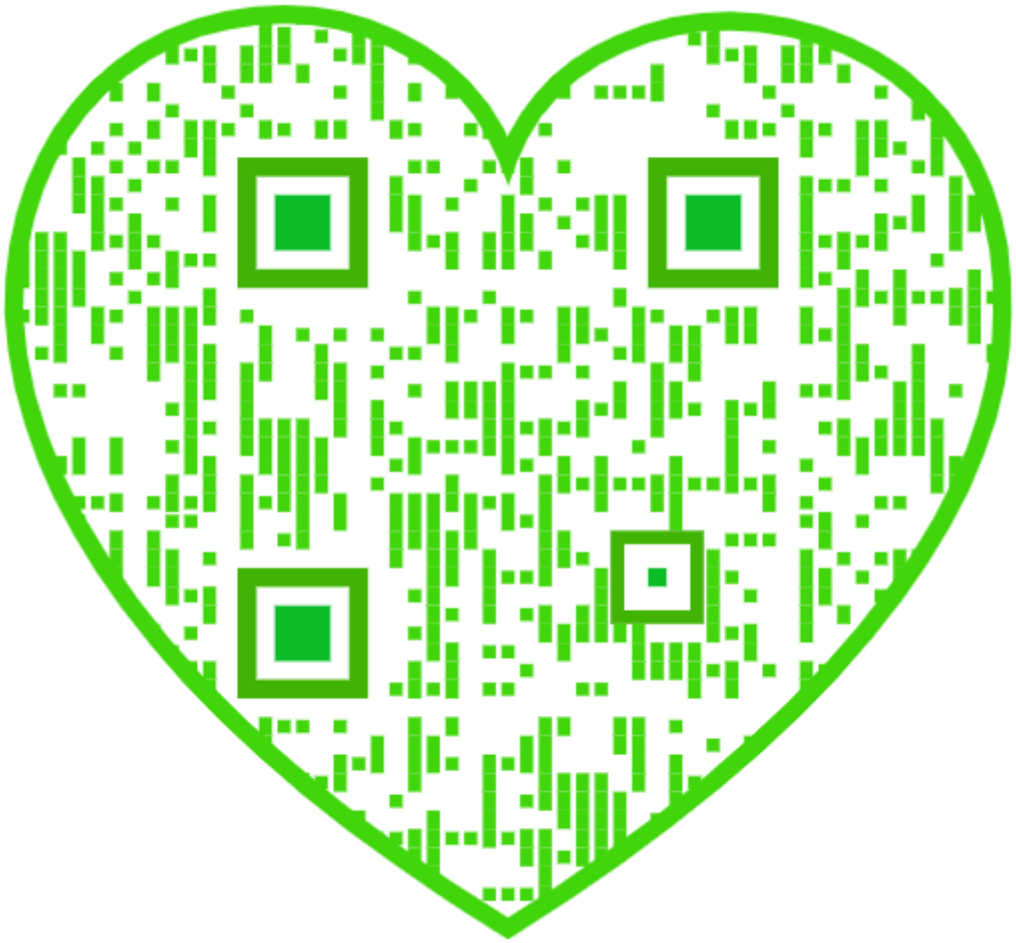

to fill an important want; and while taking as little space as an ordinary globe valve, reduces the pressure of direct steam, gas, or other fluid taken from a boiler or generator to a less pressure in the pipes or apparatus. It is used for manufacturing or heating purposes, and maintains the prescribed pressure constantly, notwithstanding the variations that may take place in the boiler above the pressure required. It can be readily readjusted, and a steam gage attached at top indicates the pressure which the valve is supplying. It is much used in distilleries, refineries, paper mills, bleacheries, and for reducing and regulating the pressure of steam supplied from boilers or street mains to houses, and steam heating in general, or wherever a constant unvarying pressure is required. It works without stuffing boxes, or rubbers, and their claims as to its qualities and capacity seem well founded.

Their steam engine indicator is one of Mr. Crosby's later productions, and is designed to obviate the difficulties heretofore thought to be insurmountable, caused by the adoption in engines of increased speed, great pressures, and high grades of expansion. By means of this instrument the internal working of a steam engine may be determined. It is a well known fact that the high state of excellence of the steam engine of to-day is due mainly to the information afforded by the indicator. When the Crosby indicator is properly applied, and its indications intelligently read, they may be implicitly relied upon even when the engine is running at the highest practicable speed. This statement is verified by the testimony of the leading experts of the country, and mechanical engineers and experts who were already fully equipped with the best the market then afforded are being supplied with the Crosby. The polar planimeter for measuring indicator diagrams in its most perfect and complete form is in process of manufacture by this company.

The Crosby safety water gage is a simple contrivance attached to an ordinary glass tube water gage without altering its external appearance, but removes all danger of scalding. Its action is so complete that upon the sudden breakage of the glass tube no steam or hot water is perceptible other than that contained by the tube at the time of breaking.

Their steam cylinder lubricator, it is said, is without a rival as to its effectiveness, economy, and reliability. It embraces the remarkable feature of sight feeding in drops, which enables the engineer to set the proper feed at once, relieving him of the necessity of guessing the rate at which it is feeding, or whether it is feeding at all. The oil is seen passing to the engine in drops, and may be regulated to deliver even less than one drop per minute, while uniform and certain action is still secured.

The Crosby low water alarm works automatically and efficiently without the use of fusible plugs, floats, cranks, springs, or moving machinery, and no part need be removed to fit it for work again after its action. It is very simple and reliable.

The "Bay State" muffler, also made by this company, is for the purpose of reducing to its minimum the harsh and disagreeable noise occasioned by the escape of steam from steam pipes and safety valves without hindering the free outflow of steam.

This company is also engaged in the manufacture of various other standard instruments, such as engine revolution registers, marine clocks, test pumps, test gages, salinometers, thermometers, pyrometers, whistles, etc.

The officers of the company are: J. H. Millett, President; Geo. H. Eager, Treasurer; Geo. H. Crosby, Superintendent; and their place of business is at corner Milk and Batterymarch streets, Boston.

A Large Holtz Electrical Machine.

Messrs. J. and H. Berge, of this city, have just completed a very large and finely constructed double plate Holtz electrical machine for E. N. Dickerson, Esq. This is probably the largest Holtz machine ever made, the revolving plates being forty-five inches in diameter, and other parts in proportion.

By means of a continuous charging apparatus attached to the machine the inductors may be readily charged without recourse to the catskin and rubber plate. The machine, together with the charging apparatus, is mounted on a massive mahogany table, which is sufficiently large to support any apparatus used in experiments. By an ingenious arrangement of mechanism the crank which rotates the large plates is made to turn the charging apparatus. This machine is capable of yielding a 26-inch spark, accompanied by a report that is really startling.

By way of contrast, this firm exhibit a diminutive Holtz machine having a 5-inch revolving plate, and yielding a 1-inch spark.

Digestive Ferment in the Fig.

M. Bouchut, who has been investigating the digestive principle of the papaw tree, has extended his researches to the common fig, and the result of preliminary experiments (*Comptes Rendus*, xci., p. 67), carried out upon the milky juice collected from a fig tree in April last, seems to show that this juice contains a powerful ferment capable of digesting albuminoid matters. As much as 90 grammes of fibrin, added in eight successive portions, at intervals of one or two days, to 5 grammes of the milky juice, and kept at a temperature of 50° C., was for the greater part digested, leaving a small amount of a white homogeneous residue, and the solution having the odor of good broth.

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NEW YORK, SATURDAY, DECEMBER 4, 1880.

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THE MAGNET IN MEDICINE.

It would make a curious chapter in the history of medicine to trace the repeated fluctuations of popular and professional confidence in the therapeutic virtues of light, heat, electricity, and other "modes of motion."

Now one, now another of these manifestations of physical energy becomes the popular cure-all, and the medical journals accumulate a vast amount of testimony offered in evidence of the beneficent power of the new curative agent. Blue light and red light, heat and cold, frictional electricity, galvanism, electro-magnetism, actinism, and the rest, have all had their day, more or less prolonged, in which men were sure that the long-looked-for panacea had been found. Then would come more critical observation, wider experience, frequent disappointment, and loss of confidence. Other explanations would be offered for some of the reported cures, the verity of others would be flatly disputed, and the much-talked-of agent would fall again into more or less disrepute. Too often in such cases its use is left to quacks, who thrive more or less upon the residue of popular confidence in the power which the regular profession has practically discarded, and exaggerate the importance of the actual facts and phenomena which formed the basis of the original craze. By and by some more than usually courageous or reputable physician takes up the investigation anew, suggests a modified view of the old belief, having verified, as he thinks, the underlying truth of it, or discovered a new phase of truth in connection with the matter, and thus sets agoing another wave of professional interest and popular favor.

With each ebb and flow of opinion and interest, there is apt to remain an increment of new knowledge, or a permanent contribution to the means or methods of medicine, which makes and marks a positive advance. An instance of this may be found in the recent substantial aid which electro-magnetism has brought to the service of curative medicine.

The latest candidate for a revival of interest is magnetism, pure and simple. Ever since the mysterious power of the loadstone was discovered, there has been probably a real though varying confidence among men in regard to its power to influence physiological processes. At any rate the use of the loadstone to cure diseases was recorded as early as 550 A.D. The researches of Baron Reichenbach, sixty years or so ago, were attended by a remarkable development of interest in the influence of this form of force. Later, Dr. Keil, in England, was a prominent advocate of the theory that the human organization is extremely susceptible to magnetic influence. Among those who submitted themselves to his tests was Professor Faraday, who failed, however, to detect any appreciable effect upon his organization from the powerful magnets brought to bear upon him.

The investigations of Dr. Alfred Smee, a man highly competent for the work, materially aided in breaking down the belief in the power of magnets to produce physiological changes. In the course of his experiments with live animals, Dr. Smee placed the web of a frog's foot and the tails of fish in the field of a microscope, and subjected them to the influence of powerful magnets; but the circulation of the blood and the condition of the capillaries gave no indication of any physiological effects from the presence of the magnets. He also tested the alleged influence of magnets upon the nervous system and the organs of sense, but eye, ear, nose, tongue, and skin were equally insensible to their power. To this negative evidence there was much positive evidence tending to show that the therapeutic effects said to have been caused by magnets could be effected as well by pieces of wood, bone, brass, or other substance, painted so as to look like magnets. Accordingly the use of magnets in medicine and in physiological investigations fell into neglect if not into contempt, the prevailing opinion among intelligent men being that magnets were without power to influence physiological processes.

A turn in the tide of professional interest in this matter—due, perhaps, to the prominence which electro-magnetism has attained in medicine during recent years—is indicated by the article on "The Therapeutical Use of the Magnet," by late U. S. Surgeon-General Dr. William A. Hammond, given in the issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 258. Dr. Hammond has been trying the effect of magnets in his practice for a couple of years or so, and is convinced that the magnet is really capable of exercising a strong physiological influence, and that there are substantial reasons for believing that it may be used to advantage in medicine. He has tried it in cases of neuralgia, chorea, and paralysis, sometimes with strong evidence of beneficial effects. Our medical readers will be particularly interested in the cases which he reports. If it should turn out that pain and disability in any form can be removed or even mitigated by the simple process of binding magnets upon the affected parts, it is obvious that the remedy should not be despised.

Apparently the time has come for a reinvestigation of the whole matter.

THE ANTHRACITE TRIAL AT THE BROOKLYN NAVY YARD.

Great interest has been felt for some time past among engineers to learn the result of the recent trial, by the United States Board of Examiners, of the high pressure boilers of the little English steamer the Anthracite, a detailed description of which, with illustrations, appeared in the SCIENTIFIC AMERICAN of Aug. 7. Its owners had put forward the great economy of fuel possible as the principal ad-

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vantage of this system, claiming that they practically obtained one horse power per pound of coal per hour, whereas about two and a half pounds of coal per horse power per hour is required in some of the best patterns of marine engines and boilers. The radical change which such success as this would cause in all steam engineering must at once be perceived, and the preliminary trials made in England, as well as the practical demonstration of the system afforded by the voyage across the Atlantic, seemed to bear out the conclusion that something at least approximating to what was claimed for this machinery had been obtained, under circumstances which made the tests substantially complete.

In view of the importance of the matter, therefore, the Secretary of the Navy, in August last, ordered a trial to be made, by a Board of United States Naval Engineers, of the machinery of the Anthracite, and their report has just been submitted to the Department at Washington. The Examining Board consisted of three Chief Engineers of the Navy—Messrs. C. H. Loring, S. P. L. Ayres, and George W. Magee—assisted by three assistant-engineers, for making and recording observations, and taking indicator diagrams, and the trial continued through twenty-four consecutive hours. The water evaporated by the boiler was carefully measured, and the coal used was accurately weighed. The vessel was made fast to the wharf at the Navy Yard, Brooklyn, N. Y., and the test was particularly directed to ascertaining the horse power obtained from the known consumption of fuel and evaporation of water. The following were the results, as given in the *Evening Telegram:*

	Pounds.
Total quantity of coal consumed	4,400
Total quantity of feed water pumped into boiler	35,114
Average steam pressure in boiler	316½
Average vacuum in the condenser, in inches	26¾
Average pounds of coal consumed per hour	183½
Average pounds of coal consumed per hour per square foot of grate	11·98
Average indicated horse power	67·7081
Pounds of coal consumed per hour per indicated horse power	2·7115
Pounds of feed water consumed per hour per indicated horse power	21.63875

It will be seen that, in this trial, so far from obtaining one horse power per pound of coal per hour, it required nearly 2¾ lb. of coal per horse power per hour. This result is attributed principally to the fact that the steam pressure was comparatively low. In the former trials, and on her voyage, about 450 lb. pressure was maintained, and the machinery is especially adapted to work constantly at a pressure as high as 500 lb. without any undue strain or wear. A further explanation is found in the fact that the Cumberland bituminous coal was used in the Navy Yard trial, while Nixon's steam navigation coal was used in the English tests. One object of the voyage of the Anthracite over here was to test the capacity of her machinery with the employment of different kinds of coal. The furnaces had been theretofore worked principally without any artificial blast, although she is fitted up with a fan blower to be used for obtaining high pressure, or should it be desirable from the nature of the fuel. It was especially intended to experiment with anthracite coal, but it will be readily understood that, in experiments with these different kinds of fuel, extending over only a brief period, the economic results obtained are not to be fairly compared with what might be achieved under a longer experience. In every other respect the trial was a decided success for the Anthracite's machinery, and it is to be regretted that the experiments were not continued long enough to practically demonstrate whether the Perkins system would or would not do all that is claimed for it.

PROGRESS IN AMERICAN TELEGRAPHY.

The annual report of the president of the Western Union Telegraph Company for the year ending June 30, 1880, furnishes many figures of interest to others than the stockholders of the company. The latter, however, appear to have no reason to complain, the net profits of the company for the year footing up over $5,000,000, the capital stock of the company being about $41,000,000. The net profits for the fourteen years from 1866 to 1880 exceed $45,000,000. The telegraph business of the year is represented by 29,215,509 messages, $12,782,894.53 receipts, $6,948,956.74 expenses, and $5,833,937.79 profits. The company has in operation 85,645 miles of line, 233,534 miles of wire, and occupies 9,077 offices. The new offices established and equipped during the year number 543. The number of messages sent was over 4,000,000 more than the year before. The increase in mileage of wire was 22,000 miles; the increase in miles of pole lines was 2,658. The ratio of expenses was 54 3-10 per cent of the receipts, against expenses of 56 2-10 per cent the previous year, and of 63 9-10 per cent the year preceding that, and the cost per message reduced to the average of 22 3-10 cents, against 23 1-10 cents the previous year, 25 cents the year preceding that, and 29 8-10 cents the year ending in 1877.

THE NATIONAL ACADEMY OF SCIENCE.

The regular November meeting of the National Academy of Science began in this city Nov. 16. This meeting is always devoted to purely scientific subjects. Among the papers read were :

"Report on the Dredging Cruise of the United States Steamer Blake, Commander Bartlett, during the Summer of 1880," by Prof. Alexander Agassiz; "On the Origin of the Coral Reefs of the Yucatan and Florida Banks," by Prof. Alexander Agassiz; "On Some Recent Experiments in Determining the Electromotive Force of the Brush Dynamo-electric Generator," by Prof. Henry Morton; "Measurement of New Forms of Electric Lamps Operating by Incandescence," by Prof. Henry Morton; "On the Intimate Structure of Certain Mineral Veins," by Prof. Benjamin Silliman; "Mineralogical Notes," by Prof. Benjamin Silliman; "On the Relationship of the Carboniforus Euphoberia to Living and Extinct Myriapods," by Prof. S. H. Scudder; "The Basin of the Gulf of Mexico," by Prof. J. E. Hilgard; "Observations on Ice and Icebergs, and on the Duration of the Arctic Winter," by Lieutenant Schwatka; and "The Turquoises of New Mexico," by Prof. Silliman.

The papers by Professors Agassiz and Hilgard add materially to the knowledge of our South Atlantic Coast, the Gulf of Mexico, and the Caribbean Sea.

Speaking of the work begun last June, south of Cape Hatteras, on a line parallel with the coast and about 120 miles distant, Professor Agassiz said that instead of finding a gently sloping sea bed, as has heretofore been supposed to exist in these latitudes, the dredgers discovered what proved to be a continuation of the plateau the northern portion of which is known to extend as far as Cape St. George, its southeasterly limit resting, it is supposed, on the Bahama Banks. The western ledge on this plateau was examined during last summer's cruise, and proved very interesting from a geological point of view. The eastern slope has not been traced. Its exact limits are a matter of conjecture, but are to be determined in next year's cruise. The sides of this plateau are steep. Three ship's lengths from a point where a depth of 100 fathoms had been reached, the sounding apparatus did not strike bottom until 450 fathoms of the line had been paid out. The most animal life is found on the edge of the plateau. The character of the animals is, on the whole, the same as that of the species found in the Gulf of Mexico and the Caribbean Sea. The edges are composed of rich deposits of alluvia and mud, washed from the top of the plateau by the action of the Gulf Stream, the course of which extends over the entire length of this Atlantic plateau. The expedition found at the outfall of the Gulf Stream a wealth of marine life larger than at any point in the tropics. The deposits of numerous rivers flowing into the Atlantic Ocean serve to enrich the western slope. The plummet would sometimes sink from 18 to 20 feet into the slimy deposit. The fauna of this region was remarkable rather for its immense quantity than for the number of species. Under the strong current of the Gulf Stream the plateau was almost entirely bare of animal life. In summing up the results of the cruise Professor Agassiz spoke of the great success of the expedition, and said that their facility in dredging had become something extraordinary by long practice, and the work they had been able to accomplish in six weeks was wonderful. When the Blake made her first cruise one haul a day was considered pretty active employment; the last day they were out this summer they made eight hauls.

In his second paper Professor Agassiz directly combated the theory of Darwin's, ascribing the production of atolls to continuous subsidence. The reefs and atolls of Florida and Yucatan furnish abundance of evidence of such formations where there has been no subsidence.

The first note of dissent from Darwin's theory was sounded in 1851, when Prof. Louis Agassiz, accompanying the Gulf Exploring Expedition, examined the structure of the Florida reefs. The only strict atoll observed was one forming on the Florida coast, which had been fully investigated by the expedition. After giving a brief history of opinion on this subject, and explaining in connection with it the structure of the Alacran reef now forming off Yucatan at a point about equidistant between the one hundred fathom line and the northwest shore of the peninsula, Prof. Agassiz instanced the latter as an illustration of what is going on upon a gigantic scale on the Florida coast, along the Windward Islands, on the coast of Cuba, and off the peninsula of Yucatan. The formation of the peninsula of Florida south of 87° north latitude, and that of a portion of the Island of Cuba, as well as the structure of the Florida and Yucatan banks, were embraced within the scope of the paper. Prof. Agassiz conceived that the foundation of the Florida and Yucatan peninsulas was laid either by volcanic action or by an original folding of the crust of the earth, and the inquiry must consequently start with the time when this substratum was laid. In order that the coral reefs might grow upon these submarine plateaus there must be a certain depth of water—about 90 feet—and there must be a sufficient drift and deposit of food at the points where they were found. From about latitude 37° the whole southern portion of Florida was built up by coral action. It was easy to understand from what sources the food supply was derived for these submarine island builders. The prevailing winds of this region come from the northwest, carrying a current along with them that floated upon its surface vast amounts of the sediment of life from very distant coasts, and here the sediment sank, some of it having traveled from as distant points as the shores of Africa. The current having passed over the Florida projection struck the Yucatan bank, and was thence reflected, leaving a large deposit along the margin of the reefs to feed the busy builders engaged beneath.

The manner in which the limestone deposit was laid upon the submarine plateaus formed by original upheaval of the earth's crust, or by volcanic agency, was next taken up and discussed. Upon the tops of the plateaus thus formed, said Prof. Agassiz, lived innumerable colonies of star-fishes and sea-urchins, which left behind, from age to age, their limestone skeletons. Mr. Murray had calculated from data obtained during the voyages of the Challenger that every square mile of the sea contains from two and a half to three tons of limestone. Thus these plateaus were raised little by little until their altitude was such that coral settlements could be established, and these little creatures could grow and build.

Professor Hilgard began by reviewing the history of the exploration of the basin of the Gulf of Mexico and its approaches since 1846. The systematic prosecution of the work did not begin until 1872. A relief model of the basin was exhibited together with a map.

The area of the entire Gulf, cutting it off by a line from Cape Florida to Havana, is 595,000 square miles. Supposing the depth of the Gulf to be reduced by 100 fathoms a surface would be laid bare amounting to 298,000 square miles, or rather more than one-third of the whole area. The distance of the 100 fathom line from the coast is about 6 miles near Cape Florida; 120 miles along the west coast of Florida; at the South Pass of the Mississippi it is only 10 miles; opposite the Louisiana and Texas boundary it increases to 130 miles; at Vera Cruz it is 15 miles, and the Yucatan banks have about the same width as the Florida banks.

The following table shows the areas covered by the trough of the Gulf to the depths stated:

Depth.	Area.	Differences.
2,000 fathoms.	55,000 square miles.	
1,500 "	187,000 "	132,000
1,000 "	260,000 "	73,000
500 "	326,000 "	66,000
100 "	387,000 "	61,000
Coast line.	595,000 "	208,000

The maximum depth reached is at the foot of the Yucatan banks—2,119 fathoms. From the 1,500 fathom line on the northern side of the Gulf to the deepest water close to the Yucatan banks, say to the depth of 2,000 fathoms, is a distance of 200 miles, which gives a slope of five-ninths to 200, and may be considered practically as a plane surface.

The Yucatan channel, which is the feeder of the Gulf, has a depth of 1,164 fathoms and a cross section of 110·36 square miles; the Strait of Florida in its shallowest part, opposite Jupiter Inlet, with a depth of 344 fathoms, has a cross section of only 10·9159 square miles. As a consequence of this disparity the waters of the Florida Strait must show a greater velocity than those of the Yucatan channel.

Referring to the model, Prof. Hilgard called attention to the important fact that the depth of water off the mouth of the Mississippi was such as to warrant the conclusion that the jetties would always prove sufficient for their purpose.

Professor Morton's electrical papers, particularly the one on the Maxim incandescent lamp, awakened unusual interest. Mr. Maxim's method of building up and equalizing the resistance of the carbon filament of the lamp was described at length. The globe of the lamp having been filled with the vapor of gasoline, the electric current is turned on. Any unequal resistance in any part of the carbon causes that part to become incandescent before the rest. The result of this local heat is that the gasoline vapor is decomposed in the vicinity of this point, and its carbon deposited upon the very spot where it is wanted. This building up of any defective points until the whole filament is of the same temperature, forms the value of the invention. Professor Morton then gave the results of his experiments with a lamp arranged to run at a high candle power, say 1,500 candles. Run under such conditions as to give a light of 40 candles, the calculation showed a development equal to 240 candles per horse power. At 52 candles the rate was found to be 336 candles per horse power; at 12 candles, 136 per horse power; at 49 candles, 426 per horse power; at 98 candles, 607 per horse power. This was far inside of what the lamp would stand; he had himself run it up to 250 candles, and it was stated by the inventor that it was capable of 1,500 candles.

Perhaps the most important information presented to the Academy, during its earlier sessions at least, was Professor Wolcott Gibbs' new method of analyzing metals by electrolysis. His plan is to place the metal in solution in a beaker, add pure mercury, and connect the mercury with an electric battery. By the electric action the metal was thrown down upon the mercury and the beaker beforehand, and then after the process to determine the metal by again weighing the vessel and the mercury. This method, he said, was applicable to mercury, tin, cobalt, and other metals. It did not apply in arsenic and antimony. He did not despair of separating potassium and sodium by the process, although his experiments with these metals had not been completely successful.

Professor Hunt said this process came with the beauty and force of a revelation; its simplicity recommended it. Every chemist would await further developments with great interest. He also asked what battery power was used. Professor Gibbs said the power of the battery was immaterial, except in point of time. The stronger the power the shorter the time required for the process. With a power equal to a Bunsen battery of 40 or 50 cells he had precipitated 15 grammes of zinc from a solution in from 20 to 25 minutes. A battery power of two or three cells would probably precipitate 3 or 4 grammes of zinc in an hour.

A Cheap Book.

We were shown the other day a copy of an edition of the New Testament, published in London, and sold at retail for one penny (two cents). Mr. Elliot Stock is the publisher, and has sold already 400,000 copies. He expects within a year the sale will number 1,000,000 copies.

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WIRE APPARATUS FOR LABORATORY USE.

BY GEO. M. HOPKINS.

Before the year 1351 everything known as wire was hammered out by hand, but at that date or thereabout the art of wire drawing was invented. Since then the art has been developed and expanded, so that at the present time wire drawing is a leading industry, and we have wire of every size and shape made from all of the ductile metals, and used in an infinite number of ways.

It is not my purpose to enter into an extended treatise on wire, but simply bring to the notice of the reader several new as well as some well known forms of laboratory appliances made of wire; and while I am conscious that this subject is by no means exhausted, I believe that the few examples of wire apparatus for the laboratory given in the engraving will not only be found useful, but will prove suggestive of other things equally as good. I have found wire invaluable for these and kindred purposes, and have often made pieces of apparatus in the time that would be required to order or send for them, thus saving a great deal of time, to say nothing of expense, which is no inconsiderable item in matters of this sort.

It is perhaps unnecessary to describe fully in detail each article represented in the engraving, as an explanation of the manipulations required in forming a single piece will apply to many of the others.

For most of the apparatus shown, some unoxidable wire should be selected, such as brass or tinned iron, and the tools for forming these articles of wire consist of a pair of cutting pliers, a pair of flat and a pair of round nosed pliers, a few cylindrical mandrels of wood or metal, made in different sizes, and a small bench vise. Any or all of the articles may be made in different sizes and of different sizes of wire for different purposes.

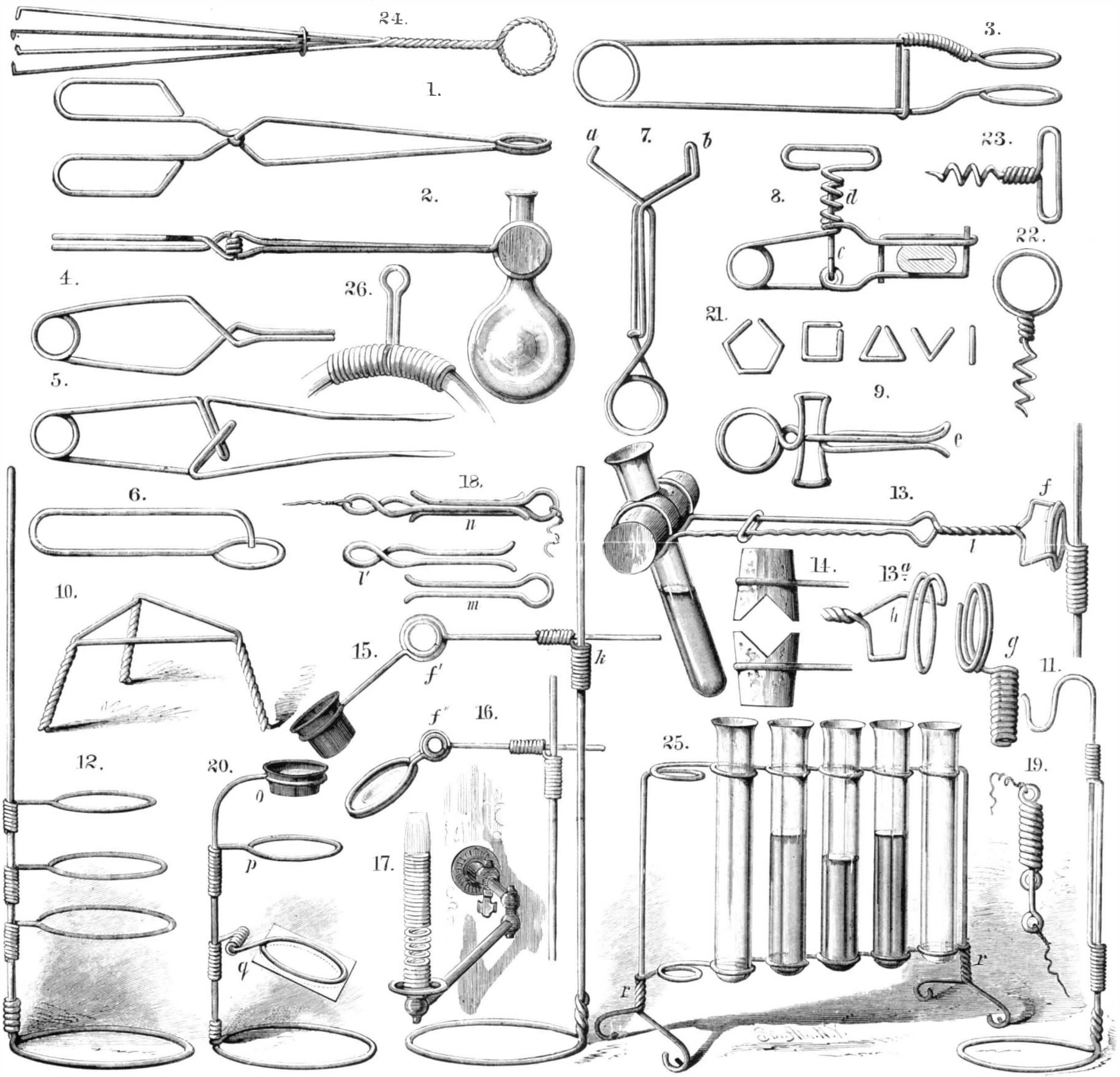
Fig. 1 shows a pair of hinged tongs, which are useful for handling coals about the furnace, for holding a coal or piece of pumice stone for blow-pipe work, and for holding large test tubes and flasks, when provided with two notched corks, as shown in Figs. 2 and 14. These tongs are made by first winding the wire of one half around the wire of the other half to form the joint, then bending each part at right angles, forming on one end of each half a handle, and upon the other end a ring. By changing the form of the ring end the tongs are adapted to handling crucibles and cupels and other things in a muffle.

Fig. 3 shows a pair of spring tongs, the construction of which will be fully understood without explanation. It may be said, however, that the circular spring at the handle end is formed by wrapping the wire around any round object held in the vise; the rings at the opposite end are formed in the same way. The best way to form good curves in the wires is to bend them around some suitable mandrel or form.

Fig. 4 shows a spring clamp for holding work to be soldered or cemented. It may also be used as a pinch cock.

Fig. 5 represents a pair of tweezers, which should be made of good spring wire flattened at the ends. Fig. 6 is a clamp for mounting microscope slides, and for holding small objects to be cemented or soldered. Fig. 7 is a pinch cock for rubber tubing; its normal position is closed, as in the engraving, but the end, *a*, is capable of engaging the loop, *b*, so as to hold the pinch cock open. Fig. 8 shows a clamp or pinch cock having a wire, *c*, hooked into an eye in one side, and extending through an eye formed in the other side. This wire is bent at right angles at its outer end to engage a spiral, *d*, placed on it and acting as a screw. The open spiral is readily formed by wrapping two wires parallel to each other on the same mandrel and then unscrewing one from the other. The handle will of course be formed by aid of pliers. Fig. 9 shows still another form of pinch cock. It is provided with two thumb pieces, which are pressed when it is desired to open the jaws. Fig. 10 is a tripod stand, formed by twisting three wires together. This stand is used for supporting various articles, such as a sand bath or evaporating dish, over a gas flame. It is also useful in supporting a charcoal in blow-pipe work.

Fig. 11 shows a stand adjustable as to height for supporting the beak of a retort, or for holding glass conducting or condensing tubes in an inclined position. The retort or filter stand, represented in Fig. 12, is shown clearly enough to require no explanation. Should the friction of the spiral on the standard ever become so slight as to permit the rings to slip down, the spirals may be bent laterally, so as to spring tightly against the standard. Fig. 13 shows



WIRE APPARATUS FOR LABORATORY USE.

1, 2, and 3. Tongs.—4. Spring Clamps.—5. Spring Pliers.—6. Spring Clamp.—7, 8, and 9. Pinch Cocks.—10. Stand.—11. Adjustable Support for Tubes.—12. Retort or Filter Stand.—13, 14. Test Tube Holder.—15. Holder for Magnifier.—16. Holder for Condenser.—17. Heating Burner.—18, 19. Electrical Connectors.—20. Microscope Stand.—21. Aluminum Grain Weights.—22, 23. Corkscrews.—24. Cork Puller.—25. Test Tube Stand.—26. Rubber Tube Support.

an adjustable test tube holder, adapted to the standard shown in Fig. 12, and capable of being turned on a peculiar joint, so as to place the tube in any desired angle. The holder consists of a pair of spring tongs, having eyes for receiving the notched cork, as shown in Fig. 14. One arm of the tongs is corrugated to retain the clamping ring in any position along the length of the tongs. The construction of the joint by which the tongs are supported from the slide on the standard is clearly shown in Fig. 13 *a*. It consists of two spirals, *g*, *h*, the spiral, *h*, being made larger than the spiral, *g*, and screwed over it, as shown in Fig. 13. This holder is very light, strong, and convenient.

Fig. 15 represents a holder for a magnifier, which has a joint, f^1, similar to the one just described. The slide, *k*, is formed of a spiral bent at right angles and offset to admit of the two straight wires passing each other. This holder may be used to advantage by engravers and draughtsmen. Fig. 16 shows a holder for a microscope condenser, the differ

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ence between this and Fig. 15 being that the ring is made double to receive an unmounted lens.

Fig. 17 shows a Bunsen burner, formed of a common burner, having a surrounding tube made of wire wound in a spiral, and drawn apart near the top of the burner to admit the air, which mingles with the gas before it is consumed at the upper end of the spiral.

Fig. 18 represents a connector for electrical wires, which explains itself. The part with a double loop may be attached to a fixed object by means of a screw. Another electrical connector, shown in Fig. 19, one part of which consists of a spiral having an eye formed at each end for receiving the screws which fasten it to its support; the other part is simply a straight wire having an eye at one end. The connection is made by inserting the straight end in the spiral. To increase the friction of the two parts, either of them may be curved more or less.

A microscope stand is shown in Fig. 20. The magnifier is supported in the ring *o*. The ring, *p*, supports the slide, and the double ring, *q*, receives a piece of looking-glass or polished metal, which serves as a reflector.

Fig. 21 shows a set of aluminum grain weights in common use. The straight wire is a one grain weight, the one with a single bend is a two grain weight, the one having two bends and forming a triangle is a three grain weight, and so on. Figs. 22 and 23 are articles now literally turned out by the million. It is a great convenience to have one of these inexpensive little corkscrews in every cork that is drawn occasionally, thus saving the trouble of frequently inserting and removing the cork screw. The cork puller shown in Fig. 24 is old and well known, but none the less useful for removing corks that have been pushed into the bottle, and for holding a cloth or sponge for cleaning tubes, flasks, etc.

Fig. 25 shows a stand for test tubes. The wire is formed into series of loops and twisted together at *r* to form legs. A very useful support for flexible tubes is shown in Fig. 26. It consists of a wire formed into a loop and having its ends bent in opposite directions to form spirals. A rubber tube supported by this device cannot bend so short as to injure it. Most of the articles described above may be made to the best advantage from tinned wire, as it possesses sufficient stiffness to spring well and at the same time is not so stiff as to prevent it from being bent into almost any desired form. Besides this the tin coating protects the wire from corrosion and gives it a good appearance.

THE STEAM BOILER SMITH.

Among the large number of notable machines inspected at the works of the Barrow Shipbuilding Company during the recent visit of the Institution of Mechanical Engineers, few created greater interest than the flanging hammer made by Messrs. Campbells & Hunter, Leeds (England), and illustrated herewith.

Flanging is a favorite method of dealing with certain joints in boilers of all kinds in these days, and the inclination is to a still further adoption of this effective operation; and although the flanging of flues has been done by machines specially constructed for that particular purpose, the bulk of flanging operations has been performed by hand, and no machine of a comprehensive character has been introduced before this.

In Fig. 1 we illustrate the operation of flue flanging. Here a flanging block, with separate anvil, is mounted upon a swiveling slide, upon which it can be moved as required. This block has a projecting angular face in front, upon which is carried an adjustable roller or rollers for taking the end thrust of the flues, plates, etc. On each side of the roller carriage are two wrought iron arms, and two others on each side of the anvil block, each arm having a small runner at the outside end; these arms keep the flue square, and the runners assist it when being turned round. For turning the flue round when flanging, two chain barrels with ratchet motion and sufficient chain are provided; these barrels are fixed in frames upon the foundation plate, one on either side of the flue; the chain is given a lap around the flue and is wound on to the empty barrel as it unwinds from the full one, or the flue can be revolved easily by hand. Flues up to four feet in diameter can be done at one heat, and so accurately finished that the leveling block is not required, and although they may have been out of truth before, when flanged they are perfectly circular. The flues of the steamship City of Rome were all done by the machine at the above named works.

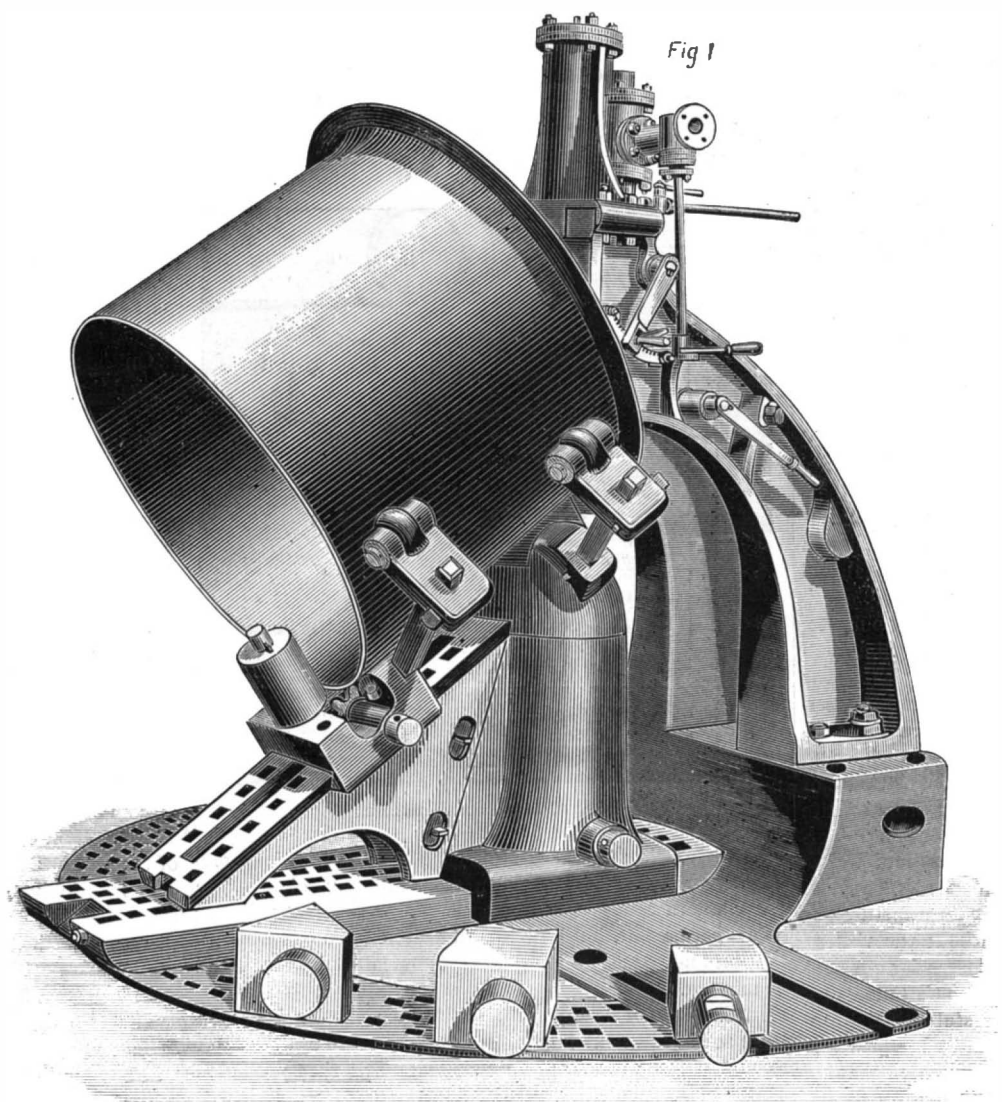

Fig. 1.—FLANGING HAMMER.

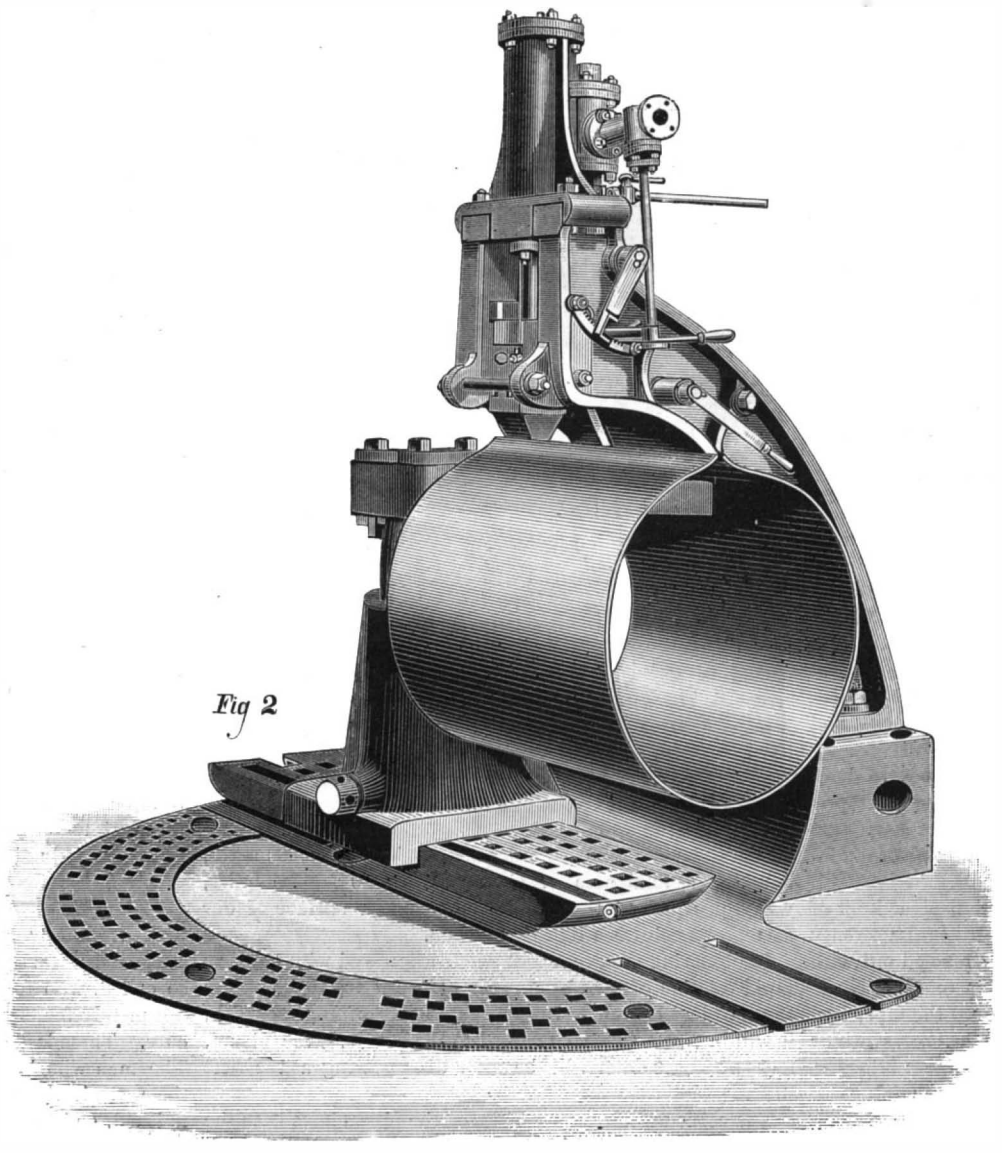

Fig. 2.—WELDING HAMMER.

The anvil block is arranged to admit a variety of anvils for flanging end plates up to fifteen feet in diameter, tube plates, dished crown plates, etc., and for setting back the bottoms of vertical fireboxes, and the guide block will admit heads to suit.

In Fig. 2 we illustrate the machine as used for welding purposes. In doing this work a welding block is mounted on the long slide; this block carries a welding bar, upon which saddles may be fitted for different diameters. The block and bar carrying the flue are traversed along the bottom slide, and as much length as can be heated may be welded at once. The usefulness of the hammer has been further developed by the Leeds Forge Company in the manufacture of their well known Fox's corrugated flues, the diameters of which at the ends are reduced upon it prior to flanging.

By the foregoing operations it will be seen that the machine covers a great range of work of a kindred character where the easily-regulated blow of the hammer is necessary for the varying conditions of hot iron.—*The Engineer.*

Manual Labor vs. Machinery.

A fear seems to have taken possession of many minds lest by the inventive genius of man machinery might be produced capable of accomplishing so much as to remove the necessity for manual labor, and, as a consequence, lest they themselves should be unable to gain a livelihood. So widely have these views been imbibed, even by men of apparent intelligence of a comparatively high order, that they have advocated in strong terms, upon the rostrum and elsewhere, the desirability of not only banishing new machinery, but inventors also. This opposition has made the path of those who possessed sufficient enterprise to lead them to devise new methods, and new apparatus to effect the same, not only unpleasant, but generally unprofitable; whereas if mankind had been more fully endowed with wisdom and brotherly love a very different state of affairs would have existed.

The cry that "the rich are growing richer and the poor are growing poorer," as the result of the introduction of new machinery is not true. In fact, the use of machinery is constantly improving the condition of all classes; and the advance that has been made by the masses toward a higher civilization the last half century is simply wonderful, and is due to the development of the inventive genius of man. That there is not an equitable distribution of the products of the farm, the mine, and the manufactory cannot be denied. But where does the fault lie? Not with the machinery either of old or new design.

Let the reader look back with the aid of proper books of reference to the condition of things fifty years ago. At that time it was beginning to dawn upon the minds of the most progressive that steam railways were a possibility; but everything for the next ten years was in the crudest possible condition, no more like the comfortable railways of to-day than a two-wheel springless ox cart is like a modern pleasure carriage. Then travel was slow and tedious for all classes, rich

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or poor. Now the rich, and the poor as well, may travel five hundred miles comfortably in twenty-four hours. Then the mails were weeks in going and coming where days will now suffice. Then telegraphs were unknown, but now any one may send a message to a friend hundreds of miles away for a few cents, and get an answer almost at once, whereas it formerly required several days if not weeks for a message to go and come. These and hundreds of other improvements that have been inaugurated are open to the use and benefit of all, and have greatly lessened the most arduous work of the laboring man, while the necessity for his services is in no wise less now than formerly. In fact it may be truly said that the day laborer can now enjoy many things that the wealthiest men half a century ago could not obtain. In looking at the facts that history presents, no man of a sound and candid mind can honestly deny that, whatever of seeming or *temporary* disadvantages may have fallen upon manual labor, by the introduction of machinery, all have been enabled to reap great advantage. The conclusion must, therefore, be that the introduction of new and improved methods of production should be encouraged, and that there is no real ground of warfare between manual labor and machinery, demagogues to the contrary notwithstanding.—*New York Mercantile Journal.*

Mechanical Progress.

It is an interesting feature of our times to note the rapid progress which has been made in manufacturing ingenuity and scientific skill in the production of substitutes for expensive or scarce raw materials and articles in general demand. It cannot be controverted that art is fast invading the domain of nature. Chemistry is enabling us to replace animal and vegetable dyes, and to form artificial gems or creditable imitations of them, which, as ornaments, answer every purpose. Mineral oils replace animal and vegetable ones for illuminating purposes, and the electric light is slowly superseding the use of noxious and costly gas. The expensive and dangerous whale fishery need no longer be pursued, nor the African deadly jungle penetrated for ivory. The sea tortoise no longer lures the adventurous sailors, nor are the ostriches of the desert hunted at the sacrifice of health and often of life itself. These genuine products have been so long in universal use as to become necessities of our civilization, unless very similar articles can be ingeniously substituted for them.

Chemistry and science have enabled us to manufacture our own tortoise shell, ivory, and feathers, without the risk of visiting wild jungles and arctic or tropical seas for our supplies. In addition to the above, the *American Cultivator* proceeds to enumerate some of the most successful artificial products which are now extensively manufactured, and which take the place, to a large extent, of more expensive genuine substances. A half dozen available substitutes for whalebone are manufactured. Ivory, so extensively in use, is superseded by celluloid. Piano and organ keys, billiard balls, hand mirrors, and handles of knives and forks, are nearly all made of this ingenious chemical substitute for ivory. In the imitation of tortoise shell, it is made into combs, card cases, napkin rings, and the like; while the pink coral, so popular with jewelers and ladies, is imitated by it to perfection.

Ostrich feathers, ever the court plumes of fashion, and held formerly at prices which only admitted of their use by the wealthy few, are now eclipsed in beauty and durability by the ingenious hand of skilled manufacture. A compound of silk or celluloid, spun glass, and other materials is now so cunningly combined as to be equally desirable with the genuine ostrich feathers, and very close examination is required to detect the original from the substitute. Artificial stone and marble are made to any extent, actually rivaling the originals in strength, beauty, and durability. Artificial alizarine is now substituted for the natural product of madder. It is not much more than one-third the cost of madder as originally supplied from the dye-root. We might, adds the editor in closing his article, find plenty of other similar examples to impress the fact of our subject, namely, the rapid mechanical and chemical progess of the times.

The "Ticker" in Wall Street.

Joaquin Miller relates the following scene familiar to most New Yorkers, but not to those who are less acquainted in the ways of this metropolis or the mysteries of Wall street:

"I went to a broker whom I had met at the Union Club," says Mr. Miller, "and told him what I wanted to learn. He kindly took hold of the tape which continually streams out from the 'ticker,' as the little wheel of fortune is called, which constantly records the rise and decline of stocks, and tried to explain all about it.

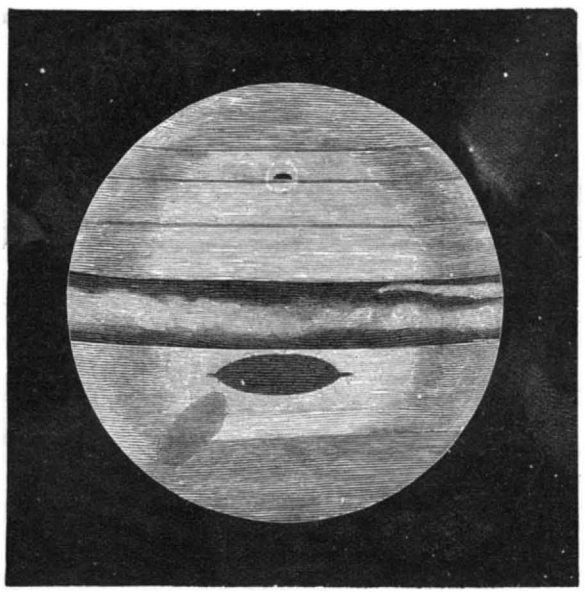
"I found it impossible to get interested. There were about 200 different names of stocks on the list. These were represented by one, two, or three letters, or figures, or some sort of abbreviated word that I could not understand or distinguish, and I was constantly getting confused.

"Around this 'ticker' gathered and grouped a knot of eager, nervous, and anxious men. Ten, fifteen, or twenty at a time would clutch at the tape, as it streamed out with its endless lines of quotations, and mutter to themselves, jabber at each other, swear like pirates, drop the tape, and dash away. Others would dart in, clutch the tape, swear or chuckle, as their fortunes went, wheel about, give orders to their broker to buy or sell, as they prophesied the future of the market; and so it went on all day from 10 till 3, when the battle was ended by the fall of the hammer in the Stock Exchange.

"When I tell you that there are more than 5,000 of these 'tickers,' or indicators, you can form some idea of the magnitude of the business. If we give ten men to each 'ticker,' you have the spectacle of 50,000 stalwart men standiug there holding up a dotted strip of paper, waiting, hollow-eyed and anxious, on the smiles of fickle Fortune. To this 50,000 you may add 2,000 brokers. You must give each broker, at least, 5 clerks, office boys, and messengers, which swell the list 10,000. To this 62,000 you can safely add 200,000 speculators on the outside. So you have a total engaged in this gambling of more than 250,000."

CHANGES ON JUPITER.

Probably never since Jupiter became an object of telescopic study has more attention been bestowed upon him, or a deeper interest felt in the wonderful changes which are



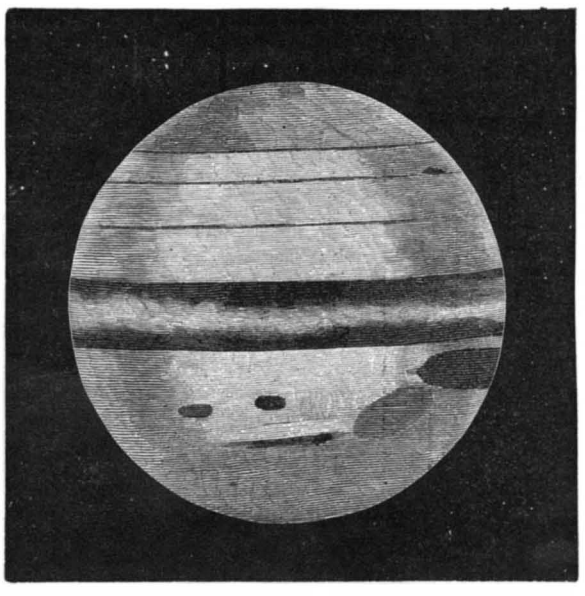
GREAT SPOT ON JUPITER.

constantly being produced on his surface, than has been created by the advent in 1878 of a tremendous "red spot" in the southern hemisphere of the planet. This great marking seems permanent, but how long it will last no one can tell. It would not be astonishing news if some fine night it should be missing.

In October, of last year, the spot was surrounded by a large sea of light extending in all directions, to a distance of some five or six thousand miles. The planet then presented a very beautiful sight, with the great spot like a light red island floating in a sea of liquid light. A large engraving, from a drawing made by me last October, in the *English Mechanic*, vol. xxx., p. 166, shows the striking appearance of the planet during that time.

This year, as soon as Jupiter emerged from the neighborhood of the sun sufficient for good observation, the great red object was sought for. It was found to have suffered no particular change, save that the sea of light surrounding it at one time last year had disappeared.

I have observed the spot on every favorable opportunity this year, and find that its length fluctuates slightly, but its breadth remains pretty constant—about one-eleventh or one-twelfth the polar diameter of the planet. I estimate its mean



SMALL SPOTS ON JUPITER.

length to be about 22,490 miles and its breadth 6,900 miles, covering a total area of about 154,640,000 square miles, which is equal to three-quarters the entire surface of our earth. Its color is a light Indian red.

In observing the great spot one is impressed with the very rapid rotation of the planet. Should we at any time observe the spot just beginning to appear at the east of Jupiter's disk, it will in two hours have passed to the center of the planet, and two hours later will be seen disappearing at the west limb.

The other prominent markings on the planet have been the two equatorial bands and three delicate narrow lines which encircle the northern hemisphere. But my desire is more to call attention to some new and important changes I have detected.

On the morning of July 25, at three o'clock, I discovered a small but distinct oblong spot in mid-transit, on a parallel of latitude somewhat greater than that of the red spot; this fits neatly in a narrow, delicate light-band, which was also new. I should estimate this small object to be about eight thousand miles in length and probably three thousand in breadth. At the same time I detected a heavy shading extending from the southwest end of the great spot. The new spot so far has been permanent, as I have observed it up to August 18. Observing the new spot on August 1, I found another which preceded it by about fifty minutes; this was yet further south, lying on the south border of the light narrow band; I have failed to detect this last mentioned spot on several observations since, and suppose it has disappeared.

On the night of August 16 I discovered a small, dark, almost black spot in the northern hemisphere of the planet; this was in mid-transit with the center of the great spot; it is remarkable for being in the northern hemisphere, as that part of the planet for the past few years has been singularly devoid of any change whatever.

On the morning of August 18, at three o'clock, I again observed the dark spot of the 16th, and also the small one of July 25; and between the latter and the great spot I detected two new ones, similar in appearance. One lay north and the other south of the narrow band of light. The shading from the great spot on this occasion had assumed a definite form, and was in reality a large, faint, but well defined object attached to the red spot, and almost equal to it in area. There is something remarkable about this shading. It is always best seen when near the east limb of the planet. At 4h. 19m. the great spot was in mid-transit—that is, midway across the disk; it appeared of a light Venetian red color, while the north equatorial belt was a warm purple, with which color also the south band was tinged. The small spot in the northern hemisphere was at the same time in mid transit, appearing almost black, and situated on the north border of the middle one of the three delicate lines crossing the disk. The shading from the great spot was very diffused and faint, while a slight continuation was running from the east end of the spot. Between the two equatorial belts, eastward, was a white glistening spot; east of this the space between the two belts seemed filled with light cloudy masses; above them the northern band was cleft asunder. I had for several days suspected the existence of the new markings, but did not have a fair observation until the 18th.

The two drawings, made with a five inch refractor by John Byrne, of New York, show all the new objects, and will be found pretty accurate representations of the planet at the given epochs. I have so far this year made ten observations of the transit of the great spot across the middle of Jupiter's disk, with the intention of determining the planet's rotation. These records will be continued until Jupiter leaves our evening skies, after which the observations will be reduced, corrected for parallax and velocity of light, etc., so that the planet's true rotation may be determined. I have found the rotation to be, approximately, 9h. 55·2m.

Observing the planet again on the 23d, the small dark spot in the northern hemisphere could not be detected; it has, I suppose, disappeared. The space between the equatorial bands was more decided in outline, and the bright spot in the spacing toned down, while the northern band was faintly cleft as far as the great spot. The belts do not now cross the planet as right lines, but are seen curved away from the large red spot, for the planet is slightly tilted, and we see more of the north pole than of the south.

ED. E. BARNARD.

Nashville, Tennessee.

Winter Employment for Amateurs.

Under the above heading Mr. H. Manfield last week pointed out one of many directions in which the amateur photographer may keep himself profitably employed during the winter months—profitably in so far, at least, as he is not wasting his time. With the permission of the editors I would call attention to another branch, and one more strictly photographic, in which the amateur may strike out for himself an almost entirely new path—not only without interfering with the course of his summer work, but actually supplementing it, while at the same time he is "keeping his hand in" during the otherwise idle months.

I allude to the production of enlargements—a department of photography which, so far as the amateur is concerned, is almost *terra incognita*. I see no valid reason why this should necessarily be the case; but it cannot be denied that it is so, for with, I think, one or two exceptions, I never recollect to have seen an enlargement exhibited which has been the production of an amateur. It may be urged that the facilities offered by commercial enterprise in the matter of enlarging are now so great that it is not worth an amateur's trouble to undertake the work. This I grant in one sense; but I am writing for that class of amateur, properly so called, who follows photography for its own sake, and not merely for the sake of the pictures it enables him to secure. These last are the rewards which crown his labors. The man who buys commercial plates and, after exposing them, sends them to be developed, printed, mounted, and finished, and is content to call the results his own, is not an amateur photographer; he is merely what is termed in the sporting world a "pot-hunter."

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The real amateur is he who prefers to do every bit of work himself that it is within his power to do. He prepares his own plates, makes his own collodion and emulsion, and would albumenize his own paper or make his own carbon tissue if it were possible on a small scale to equal or even to approach the commercial article. I see no reason why the amateur of this class should not therefore turn his attention to the production of his own enlargements.

A word, first of all, upon the subject of enlargements. What is an enlargement? or rather, what is the limit to which enlarging can be carried without producing an offensive result? In other words, is it necessary to carry the amplification to the extent which has become so fashionable, and of which a few examples are to be seen in the present exhibition, though not so many as last year? I, for one, reply at once that it is neither necessary nor desirable to convert small landscapes (the greater proportion of amateur work will be in that line) into pictures of forty inches by thirty, or even larger. For one thing, the optical conditions under which the negative is taken will rarely permit it, while the productions are like "white elephants," perfectly useless and problematically ornamental.

If, however, the amateur be content with enlarging up to 12 x 10, 15 x 12, or 18 x 16, he will not get beyond the bounds of what he can do and *do well*. He may save himself a great deal of hard work in taking his negatives, as a quarter or 5 x 4 pocket camera will enable him to produce 12 x 10 or 15 x 12 negatives when enlarged only about three diameters—a degree of amplification which will not overtax his optical powers to any very serious extent. Moreover, he will be enabled to produce pictures of this or even larger sizes at a minimum cost for apparatus.

And now as to the methods by which these results are to be secured. If a lantern be available—as is generally the case in amateur photographic establishments—so much the better; though it is not an absolute necessity, it will add much to the convenience of the operator. Failing that, a darkened room with a hole cut in the shutter to receive the negative or transparency, and fitted on the outside with a dead white reflector set at an angle of 45°, will replace the lantern carrier and render unnecessary the condenser. Two upright frames, capable of standing firmly by themselves—one to carry the lens and the other the sensitive surface—and a plain table upon which to set them, will complete that part of the arrangements.

The next point is the production of the transparency. (I am presuming that an enlarged negative is to be made.) I have produced myself, I think, the best results for enlarging purposes by contact printing upon *slow* collodio-bromide plates. If the old process with excess of soluble bromide and a simple tannin or coffee preservative be employed, the most delicate and, at the same time, brilliant results may be obtained; but the finest preservative of any is albumen rendered slightly alkaline. Carbon tissue gives very good results in the transparency when it is even in quality. When using this for transparencies I prefer, after sensitizing, to "squeegee" it on to collodionized glass, and, when dry, to strip it off with the fine surface of the glass. This secures better contact with the negative, which is a matter of great importance, and leaves less granularity and unevenness in the developed image. Gelatine plates—at least the modern rapid ones—are inferior in result. A special plate may, however, be prepared, but it is scarcely worth while when carbon tissue is so cheap.

With regard to the enlarged negative for sizes up to 12 x 10, I think the ordinary gelatine plate should be used; but for sizes beyond that I should prefer paper waxed or not as circumstances may dictate. I question, indeed, whether in a 12 x 10 print from a paper negative a sufficient grain would be visible to be noticeable. Two methods of preparing the paper are open: the first, to coat paper with ordinary gelatine emulsion; the second, to salt and sensitize it as recommended by Captain Abney, the ferrous oxalate developer being used in both cases. The operation of coating the paper with emulsion will be rendered perfectly easy if it be performed in the following manner: Take a sheet of glass (preferably plate) the size of, or a little larger than, the required negative; thoroughly damp the paper to be coated, and squeegee it on to the glass, turning the edges over. Blot off the surface water, and, while still damp, pour on the gelatine emulsion in the ordinary way, placing the glass upon a leveled stand. When set, treat it in every way like an ordinary gelatine plate, taking care not to disturb the edges of the paper until the whole is thoroughly dry, when the gelatino-bromized paper may be stripped from the glass in a perfectly even sheet without wrinkles or cockling.

The gelatinized paper cannot be rendered so translucent by waxing as the plain, as it is more difficult to make the wax penetrate it. The plain paper negative may be soaked in hot water after fixing to remove the soluble portions of the sizing, and, when dry, the wax will be easily absorbed. This treatment is obviously inapplicable to the gelatino-bromide paper.

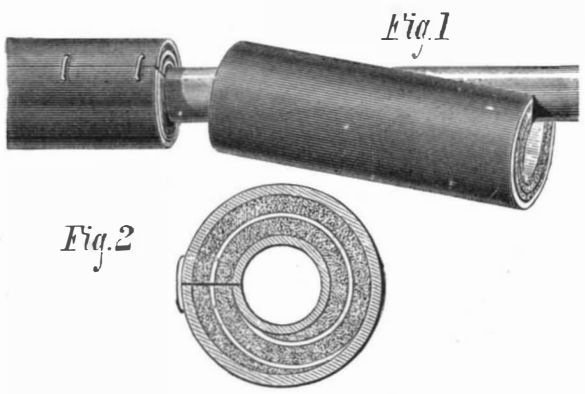
It will, of course, be possible to print direct enlarged positives from the original negative, employing in the same manner the bromized or gelatino-bromized paper and oxalate development. In this case it will be advisable to add a full dose of iodide to the salting bath or the emulsion, as the case may be, in order to improve the tone. The preferable plan, however, according to my idea, is to make an enlarged negative.

In these few lines it is impossible to do more than merely sketch out a plan by which amateurs may make their own enlargements with no greater trouble than is required to produce the direct negatives, if, indeed, as much be necessary. I hope the matter will be taken up by some of our more practical amateurs during the approaching season, and that we shall hear and see more of my suggestion next year. —*H. Y. E. Cotesworth, in British Journal of Photography.*

FELT AND ASBESTOS COVERING FOR STEAM SURFACES.

For some time past Toope's covering for steam surfaces has been in use in England, giving great satisfaction and receiving the indorsement of many prominent English engineers. The business of manufacturing and selling it is conducted there by a limited company located in London. In this country Mr. Charles Toope, manufacturing agent, having an office and works at 353 East 78th street, New York city, is making and introducing the covering.

The covering is readily applied, requires no previous preparation, and when in place is permanent, being incapable of injury by jarring or pounding. It has a smooth and finished appearance, and is said to be much more efficient for the same thickness of material than other forms of covering, and it possesses the further advantage of not being liable to crack or crumble, a common difficulty with some forms of covering applied in a plastic state.



TOOPE'S REMOVABLE COVERING FOR STEAM SURFACES.

This covering is made by wrapping a mandrel with asbestos, and applying a layer of paper, which is afterward wound spirally with an interposed layer of felt, and is finally wrapped upon itself, forming a stiff exterior coating, as shown in Fig. 2 in the engraving. The covering thus formed is cut into convenient lengths, and slit open on one side so that it may be readily placed on the pipe, as shown in Fig. 1. The fastening consists of a series of staples, inserted so as to draw the seam together. For flat surfaces the covering is made in sheets of convenient size.

This covering can be removed and replaced without injury, and may be applied to the pipes whether hot or cold. It is extremely light, and is said to be indestructible at any temperature at which steam is used. It is valuable as a covering for gas and water pipes, pumps, and other similar surfaces, to prevent freezing.

This invention has been patented in the United States, Great Britain, France, and Germany.

MISCELLANEOUS INVENTIONS.

An improved mop-head has been patented by Mr. John K. Collins, of Lebanon, N. H. This invention consists in a novel combination with each other of a mop-holder provided with a notched or serrated shank, and a mop-head provided with pivoted spring pawls engaging with the shank.

Mr. Stephen N. Rowley, of Adrian, Mich., has patented an improved ruffling attachment for sewing machines which will allow the goods to extend at either or both sides, and thereby permit a wider range of work than is possible with ruffling attachments for under-feed machines as heretofore constructed.

Mr. Frederick Diffany, of Newark, N. J., has patented an improved ornament to be used in the manufacture of jewelry, so constructed that it may be made or boughtin strips, cut into pieces of suitable length, and applied to the jewelry to be ornamented.

An improved self-inking hand stamp has been patented by Messrs. Thomas Keith and Andrew Philp, of New York city. The invention consists of a die plate guided by vertical slots in the standards of the frame of the stamp, and pivoted to arms rigidly attached to a transverse bar attached to the handle, which die plate has a fork on the lower side, embracing a stud or pin attached to a rod provided with a symmetrically beveled guide plate, and fitting into a receptacle containing a spring, which forces the guide plate forward against the gudgeon of the die.

Mr. Alfred Beard, of Cincinnati, Ohio, has patented a wrench having a circular eye in its head for the reception of a pipe or nut, the head being traversed by a slot through which an adjustable tapering toothed key is entered to any desired extent to press upon and hold the pipe or nut.

An improved sawmill dog has been patented by Mr. Elwood Bennett, of Kokomo, Ind. The object of this invention is to furnish dogs for sawmills, so constructed as to hold the timber firmly while being sawed, and which may be easily raised from, lowered to, and forced into the timber.

Messrs. Oren Rubarts and John J. Dubruille, of Albany, Oregon, has patented a saddle-horn made of malleable iron, and provided with lugs extending downward on each side and toward the front and rear of the saddletree, whereby both the horn and the tree are braced and strengthened, and provision is made for the ready attachment of the horn and its removal and replacement when necessary.

Mr. Lorenz Lebet, of Pacific, Mo., has patented an improved stock car, arranged in such a manner that stock can be conveniently watered and fed without being removed from the cars.

An improved cultivator has been patented by Mr. Addison Lupton, of Troy Grove, Ill. The object of this invention is to enable plants to be cultivated when small without covering them with clods or soil, and when larger without cutting off or injuring the roots of the plants.

New Water Supply for the City of Oakland.

Near the summit of the Coast Range dividing Alameda and Contra Costa counties, six or seven miles north of the city of Oakland on the Morago Valley road, is situated the property known as the Luch's ranch. On this ranch and near the road above named, a tunnel was started in the side hill, about four years ago, with the purpose of prospecting for coal. After more than two years of persevering and unremunerative labor, for no coal was found, and an expenditure of many thousands of dollars, the company was about to withdraw from the field when a last attempt was decided upon, and a winze ordered to be sunk from the extremity of the tunnel. After a few days' work, instead of striking coal, the astonished miners met with a stream of water so powerful that they had to flee for their very lives; and planks, timbers, wheelbarrows, picks, and shovels were washed out of the tunnel with a frightful velocity. The company being apprised of the fact, went out to see the phenomenon. After having tasted the water, ascertained its quality by analysis, and determined by further investigation that the extent of the underground water basin was of considerable magnitude, the idea of supplying the city of Oakland with pure water originated with the owners of the tunnel.

They at once sent for Mr. John Graham, an expert in waterworks, to have his opinion about the feasibility of supplying the city of Oakland with pure water from the tunnel. Mr. Graham was formerly the superintendent of the Temescal reservoir. This reservoir with its enormous dam was built by Mr. Graham, who also laid the distribution mains clear into Oakland. This Temescal water system, a part of the Chabot water supply, having proved a success in every particular, and no accident whatever having happened during the construction of the works, the tunnel company thought that Mr. Graham would be the proper person to take charge of its works, if it was deemed advisable and profitable to erect them. Mr. Graham, moreover, had built successfully a whole system of waterworks near Edinburgh, in Scotland, at a place named Dunbar, and also has erected waterworks for the village of Worcester, in New York State, this country. Mr. Graham, after considerable investigation of the tunnel water supply, and of the watershed between the summits, which is over 10,000 acres, with many beautiful springs oozing from the hill sides, concluded that water enough could be accumulated there to supply the city of Oakland with its future extensions for 40 years to come. Mr. Graham, after mature reflection, proposed a double system of supply, which is at present under way of being carried out. The magnificent water coming from the underground basin in the tunnel, so delightful in its quality and coolness, would be carried to Oakland in a separate system of mains to be used for drinking and culinary purposes only. The water derived from the springs in the hill sides, and from the rain shed (the lands here are all rock and gravel), although of as pure a quality as those of the San Francisco Spring Valley, would be carried in separate mains to Oakland to serve for laundry purposes, washing carriages, and irrigation, and also for the extinguishing of fires occurring in the city.

These last waters would be kept in a gigantic reservoir, formed by a dam 150 feet high, erected at a place in the cañon 725 feet above the grade of Oakland. As the waters of this reservoir would be conducted directly to the city in a 16-inch main pipe, it is expected that the pressure would be such as to need no fire engines in case of fire to throw the water on to the highest building possible. This, it is expected, would be a great saving to the city, and this alone would be a feature to commend it highly to the favor of the inhabitants of Oakland. Mr. Graham has commenced the construction of the work in earnest, and has been actively at work building a cement and brickwork reservoir to receive the pure waters from the tunnel as they flow out of it. This reservoir, or kind of filtering basin, is intended to catch any gravel or small stones that might be kept in suspension through the velocity of the tunnel waters. These on leaving the basin will be carried through a 12-inch pipe into a reservoir built of masonry and cement, situated near the Deaf and Dumb Asylum, opposite Judge Garber's place. This reservoir is 430 feet above the level of the city of Oakland, is 150 feet in diameter, 60 feet deep, and at a distance of 4 miles from Oakland.

The grading for a line of pipes leading from the filtering basin to the reservoir is being dug along the side hills, and will soon be ready for the laying of the pipes. Soon after this work is performed, and while laying the pipes to conduct the tunnel water to Oakland, the erection of the immense dam across the cañon will be commenced. We expect at some future day to publish in this paper, illustrated with plans and profiles, the whole scheme of the Summit waterworks, to serve as instruction to the interior towns who have not the good fortune of having at hand such a practical man as Mr. John Graham.—*Mining and Scientific Press.*

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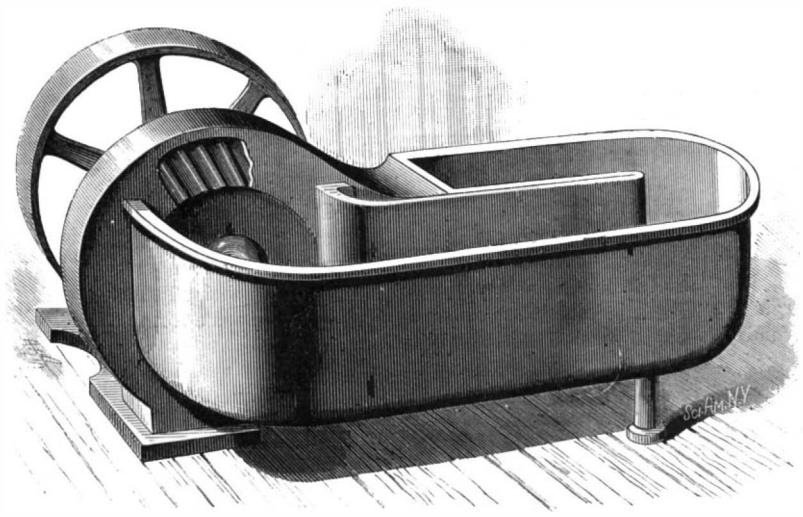
PULPING MACHINE.

The engraving represents a machine for washing, beating, pulping, grinding, ragging, disintegrating, shredding, mixing, or preparing the various materials and fibrous substances used for making paper pulp and for other like purposes, or for grinding colors, dyes, paints, and other materials.

The invention consists in a roll or disk provided with bars or ribs on one face, and fitted for revolution within a chamber at the end of a cistern or trough. The inner surface of the chamber is also faced with bars, between which and the bars on the disk the material is ground. The revolving disk is fitted with lifters at its outer edge, which act to carry the material around in the chamber.

This invention was lately patented by Messrs. E. B. and J. Cooke, of London, and Mr. G. Hebbert, of Richmond, England.



MACHINE FOR PULPING AND GRINDING FIBROUS MATERIAL.

Poisoning from Quassia.

It is a very rare thing to hear of poisoning from quassia, so often used as a bitter tonic, although the fact is known that it possesses some narcotic properties. The *Lancet* records a recent case of poisoning from an overdose given in the form of an enema. As no antidote has been published, it may be of interest to state that the remedies used in this case, and which proved effectual, were powerful stimulants, such as ether, sal volatile, and brandy, aided by hot-water applications to the feet. The pupils were strongly contracted, and the symptoms exhibited appeared to somewhat resemble those following poisoning by opium.

IMPROVED STONE CRUSHER.

The engraving shows in perspective and in vertical section an improved stone crusher lately patented by Mr. S. L. Marsden, of New Haven, Conn., and now being manufactured by the Farrell Foundry and Machine Company, of Ansonia, Conn. It possesses several points of novelty which are shown in the small sectional view. The machine is driven by an engine secured to one side of its heavy frame, and connected directly with its shaft, thus avoiding the friction and the expense of belts or intermediate machinery.

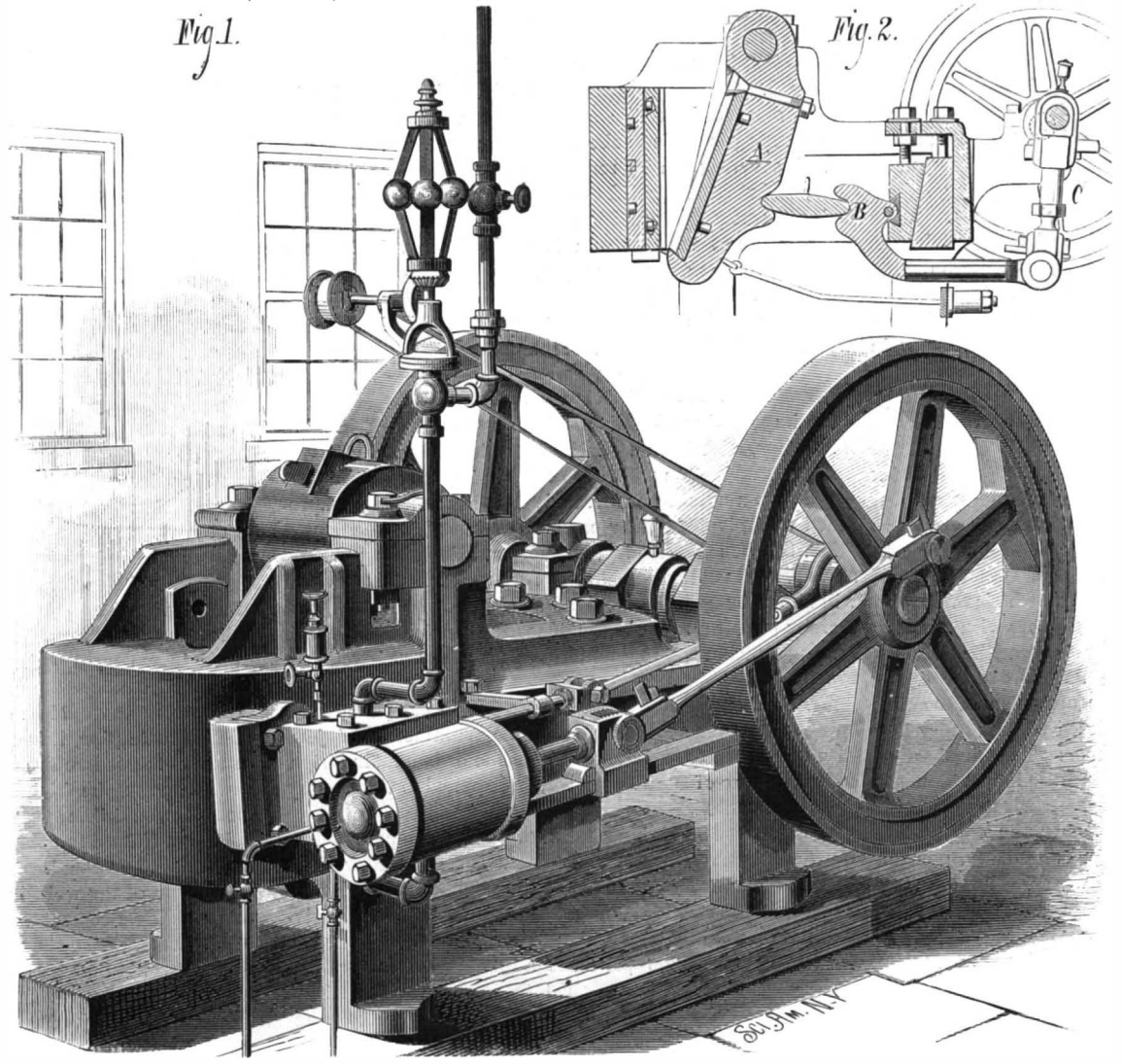
The jaws in this machine do not differ materially from those of other machines of this class, but the mechanism for operating them is materially improved. The movable jaw, A, receives its motion through a toggle from the lever, B, which is fulcrumed in a beveled block suspended from the top of the frame, and backed by a wedge that may be drawn up more or less to compensate for wear and to adjust the working distance between the movable jaw, A, and the fixed jaw. The beveled face of the wedge is concave, and the adjoining face of the fulcrum block of the lever, B, is made convex to render the block self-adjusting and afford a uniform bearing for the lever, thereby avoiding breaks due to bringing all of the strain upon a small surface.

The pitman, C, is made in two parts, adjustable by a screw, so that the length may be varied and at the same time the rigidity of the pitman is maintained.

To compensate for wear the parts of this pitman may be partly unscrewed from each other, and when the worn parts of the crusher are renewed the pitman may be shortened by screwing them together.

This machine is on exhibition at the Fair of the American Institute, crushing hard bowlders and cobble stones with perfect facility.

The machine is provided with a pulley so that it may be driven independently of the engine should occasion require. And on the other hand the engine may be used to drive other machinery by disconnecting the stone crusher pitman.



MARSDEN'S STEAM STONE CRUSHER.

Charcoal.

If we wish for some substance which will catch fire from the smallest spark, we find that among thousands of bodies, simple and compound, that exist in nature or are produced by art, the most suitable for our purpose is pure carbon in the form of tinder. On the other hand, when we want a crucible that will bear without taking fire the flame of the hottest furnace, we make it of pure carbon in the form of plumbago.

The wax mould of the electroplater is a non-conductor of electricity, and is, therefore, necessary to cover its surface with some good conducting material; it is found that the best material is finely pulverized plumbago; but this same element when crystallized, as in the diamond, is the most perfect of all non-conductors!

Carbon in one state is as soft as lampblack, in another it is the very hardest substance known; in one it is brilliantly transparent, in another it is perfectly opaque; in one it is the most costly ornament in the crowns of kings, in another it is shoveled out of the way as worthless!

In all these changes in the condition and properties of carbon no law can be discovered, with the single exception that the temperature at which various kinds of charcoal will take fire are in fixed relation to the temperature at which the several kinds are prepared. This is of the utmost importance to the manufacturers of gunpowder; they have caused it to be investigated with great care.—*Monthly Magazine, London.*

The Improvement of the Mississippi River.

The Mississippi Valley Interstate Convention, having for its object the improvement of the navigation of the Mississippi River and its tributaries, was organized at New Orleans, November 17. The officers elected were: Hon. H. F. Simrall, of Mississippi, President, with vice-presidents from Louisiana, Missouri, Kentucky, West Virginia, Pennsylvania, and Ohio; Secretaries, H. Dudley Coleman, John Henderson, James N. Scuddy, and T. Wharton Collens.

Enemies of the Wheat Plant.

BY REV. C. J. S. BETHUNE.

[Read before the Dominion Agricultural Commission.]

The most destructive insect pest to the wheat crop is the wheat midge, or *Cecidomyia tritici*, which had been first observed in America in 1820, when it was discovered in the State of Vermont, having been imported, like most of our destructive insects, from Europe. It spread with great rapidity over the Eastern and Central States and Canada, and in 1856 the loss to Canadian agriculturists from its ravages was estimated at $2,500,000, while in the following year, 1857, it was calculated that $8,000,000 bushels of wheat were destroyed in the Province of Ontario alone. From that time up to 1868 it continued to be very destructive, but since 1869 it had been almost unknown. It is probable that the checking of the midge plague was due partly to a parasite which preyed upon the insect itself, and which was well known in England and the countries of Europe, though owing perhaps to its extreme minuteness it had never been detected in this country, and partly to the general introduction of what were known as midge proof varieties of wheat. Some of these varieties resisted the midge on account of the hardness of the envelope which inclosed the kernel, and some on account of their maturing either before the midge became formidable, or after it had ceased to be so. The midge resembles the Hessian fly in appearance, the main difference being that the color of its body is yellow, while that of the Hessian fly is black. It frequents the ripening ears of the grain, and lays its eggs in the blossom of the wheat. As soon as the larvæ are hatched they begin to feed upon the juices of the grain, causing the latter to gradually shrivel up and become useless. When the period of the ripening of the grain arrives, the midge descends into the earth, remaining there throughout the winter. In the following spring it emerges into the pupa state, and in the month of June becomes a perfect insect. It is fond of moisture, and therefore likely to be found in low-lying lands, or lands not thoroughly drained.

The Hessian fly, or *Cecidomyia destructor*, is of older standing on this continent than the midge, its first appearance in America being about the year 1776. It was first observed in Ontario in 1846, and since then has been a very familiar insect, though its ravages have not been serious of late years. Although the insect is very similar to the midge, its mode of attack is entirely different. It appears first in the fall of the year at the roots of the plants, lays its eggs, and the larvæ are hatched out and remain in the earth all winter, the brood appearing in the spring. There is a second brood in the spring which attacks the stalk, and it is upon this portion of the plant that the Hessian fly is most commonly observed. There are happily a number of parasites which prey upon this pest, the chief being a species of apis, ichneumons of various kinds, and probably some of what are more properly termed bugs. Spring wheat is not so much affected by this pest as fall wheat, as the grain ripening the same season in which it is sown affords no place for the larvæ to hibernate during the winter. This fact would point out as a remedy for the Hessian fly the abandonment for a time of the cultivation of fall wheat, and the substitution of spring wheat. Another remedy would be the sowing of fall wheat as late as practicable in the fall, in order that the larvæ might not find the plant sufficiently advanced for its attacks at the root before the winter sets in. Thorough cultivation would also aid in lessening the damage done by this pest, as the stronger and more healthy the plant, as a matter of course, the less it would suffer from the ravages of the fly.

The chinch bug, or *Micropus leucopterus*, might be called the most powerful insect foe of the United States agriculturist, but it has never been known to be destructive in Canada. Our proximity to the States, however, renders us liable to an invasion by this plague, and there is nothing except a slight difference in climate that would warrant the belief that it would not thrive in this country. It is an in-

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sect that requires heat and drought, to long-continued spells of which the Western States are much more subject than the older provinces of Canada. There is, however, great danger of its importation from Minnesota into Manitoba, where the climatic conditions are very similar. It has been seen in Canada, and in 1866 the writer published a description of it in the *Canada Farmer*, from specimens which had been forwarded to him from Grimsby. It attacks other grains besides wheat, and like many other insect pests, it is hibernating, existing throughout the winter in its perfect state. In the Western States, where it is abundant, there are a great number of broods during the year. One of the remedies used is the application of water. A heavy thunderstorm during the seasons of its ravages is worth millions of dollars to the farmers of the Western States. It attacks the heads of the grain, clustering round them, and extracting their juices by means of its proboscis. A number of the larger carnivorous insects prey upon this creature, such as the lady-bird, the lace-winged fly, and the syrphus fly.

The same parasites are useful in this case as in the case of the grain fly, or *Aphis avenæ*. This latter belongs to the widely distributed family of *aphidæ*, or plant lice, which were so destructive to flowers grown in conservatories, windows, etc., and which were consequently well known to everybody. The ravages of the grain aphis were never so serious as to give any cause for alarm, though in 1861 it was quite a plague to the farmers of the Province, but it had not been very destructive since. Its diminution was attributable to the parasites which he had already mentioned as preying upon this insect in common with the chinch bug. Thunderstorms also wash off and kill large quantities, as they have no means of regaining their position on the plant.

The joint worm, or *Isosoma hordei*, is especially injurious to barley, but it is not common in America, though in 1866 and 1867 it was somewhat prevalent in Ontario. It attacks the grain near the second joint, and the result of its work is to raise a gall or excrescence somewhat like a joint, hence its name. It does not attack the ear. The best artificial mode of dealing with it is to burn the stubble of the grain infested by it.

The army worm, *Hencania unipuncta*, is much more common in the United States than in Canada, and receives its name from the fact that it assembles in large numbers when its food is exhausted in any particular locality, and moves away in search of fresh supplies. New Brunswick was lately visited by this pest in such numbers as to put a stop to railway trains through the quantities slaughtered on the tracks, but they have never yet visited Ontario in anything like considerable numbers. A good way to meet this approach is to dig a deep trench and allow them to accumulate in it, afterward covering them with straw or shavings and setting the trench on fire. A number of parasites both of the ichneumon and beetle kind prey upon the army worm.

The wire worm, or *Agriotes mancus*, is sometimes very troublesome to wheat. It receives its name from the fact that it is a long, slender grub; it attacks the root of the plant underground, and is consequently seldom observed by the farmer. It is sometimes seen in plowing, and where it is observed, a good plan would be to have children follow the plow and gather the insects up and destroy them. Turkeys and ducks also eat them.

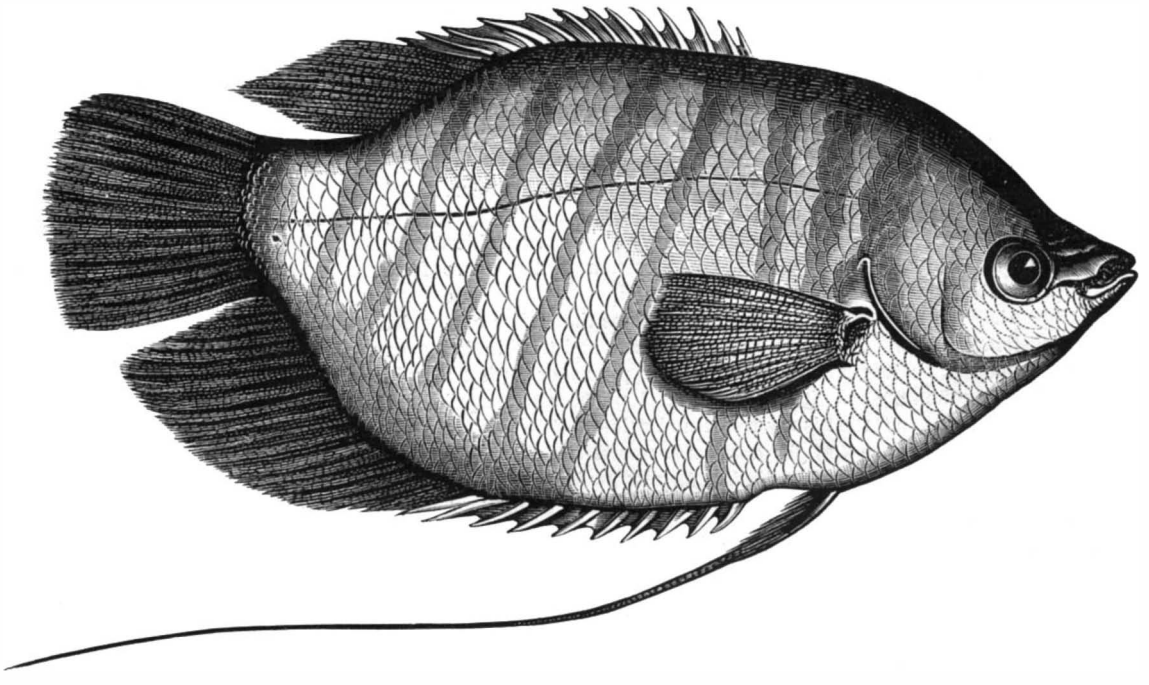
THE GURAMI.

The gurami (*Osphromenus olfax* or *Trichopodus mentum*) attains a length of from 6 to 7 feet and a weight of about 25 lb. The back is brownish-red in color, and the abdomen of a silver color, with brown spots, and dark brown-red stripes pass from the back to the abdomen of the fish.

The fish originally was an inhabitant of Chinese waters, but was taken to Java, Sunda Islands, etc., on account of the good quality of its flesh. It lives on potatoes, salad, bread, rice, beans, worms, raw and cooked meat, small fishes, and frogs, and in fact will devour almost anything.

The male fish builds a nest among the plants of the pond, in about five to six days, and the female lays in it from 800 to 1,000 eggs.

As the gurami is very easily acclimatized it might with advantage be introduced into our rivers, it being very hardy and easily fed, and its flesh is of a very good quality.



THE GURAMI—(*Osphromenus olfax.*)

Mr. John H. Salter, of St. Mary's, Pa., has patented an improvement in magazine firearms, which relates to that class of breech-loading firearms, particularly magazine arms, wherein the breech-block is moved longitudinally back and forward by means of a lever; and the objects of the invention are to obtain a direct and solid resistance against the breech-block when closed and to permit rapid loading and firing with the gun at the shoulder.

THE GLUTINOUS SALAMANDER.

BY C. FEW SEISS.

This batrachian (*Plethodon glutinosus* (Green), Baird), which is known by some authors as the viscid salamander, can be distinguished from our other salamanders by the following characteristics: Head oblong, not as broad, short, and rounded in front as in the amblystomas; form rather robust for the genus (the amblystomas are generally much stouter); tail cylindrical; limbs short and rather stout, with the inner toes small, but distinct. There are 14 folds in the

THE GLUTINOUS SALAMANDER.—(*Plethodon glutinosus*, Baird.)

skin (*costal plicæ*) on the sides of the body between the shoulder and the groin, while the red-backed species (*P. erythronotus*) has 16 to 19. The general color is black, sometimes with a violaceous tinge; the throat and abdomen are generally paler in color, with a whitish band across the throat fold. The head, body, and legs above are sprinkled with white or bluish white dots and small spots, most numerous on the sides, the spots generally disappearing half way down the tail. Beneath spotless, excepting the lower jaw and throat. Total length (our specimens) $3\frac{1}{2}$ to $5\frac{5}{16}$ inches.

We have not been able to find this salamander near Philadelphia, or in parts of Montgomery and Chester counties, nor portions of Camden county, N. J. It is, however, to be met with in many parts of our State. It does not appear in Prof. Verrill's catalogue of the batrachia of Maine, and Prof. Allen says it is not common in Massachusetts. Dr. De Kay calls it the "blue-spotted salamander," and includes it in the fauna of New York State.

Ralph W. Seiss furnishes me with the following remarks: The *glutinosus* is rightly named, for unlike other urodelans of my acquaintance, it is covered with a glutinous slime, which, when brought in contact with the hand in capturing the animal, leaves an adhesive, albuminous substance upon the fingers, which is somewhat difficult to wash off. While in Hunterdon county, N. J., this summer, I collected six individuals. They were all, with one exception, captured under rotten logs, one being found in the center of a log which was sufficiently decayed to be readily broken to pieces. These specimens were very lethargic and inactive, much more so than even the red-backed salamander, allowing themselves to be captured without making any effort to escape or to bite. When placed in the water, this species, like the *P. erythronotus* (red-backed), becomes very lively, doing his best to escape from the seemingly unwelcome element. I, however, obtained two of my specimens within a yard of the water. I captured several of this species, the red-backed and the gray variety of the red-backed (*P. cinereus*), in the immediate neighborhood of each other. In one instance, I found a glutinous and red-backed salamander under the same log. I know nothing in regard to its breeding habits. Prof. Cope, however, says it probably never enters the water, but its eggs are hatched in damp places on land.

I have placed beside the salamander a cloak-bearing longicorn beetle (*Desmocerus cyaneus*, Fabr.). It is a handsome species, being of a deep blue color, with purple reflections, and the anterior portion of the wing covers (*elytra*) orange-yellow. It is found in June and July upon the common elder (*Sambucus canadensis*, Lin.), and its young bore into and feed upon the stems. I have never known it to be injurious to other plants.

A New Leaf-Cutting Ant.

BY REV. G. K. MORRIS, VINELAND, N. J.

At Island Heights, a new summer resort on Barnegat Bay, N. J., I have found a new leaf-cutting ant. That it belongs to the *Attidæ* is the opinion of both Dr. McCook and Mrs. Treat. It has the rugosity on the head which characterizes Dr. McCook's Texas cutting-ant, and resembles it in so many other particulars as to leave no doubt of their relationship generically. This, however, is much smaller, being not much more than an eighth of an inch in length. Like other leaf-cutters it carries its burden on the top of its head and along the back. A row of them marching in single file, each carrying a piece of the fine needle-like leaf of tender pine seedlings, suggests a file of soldiers armed with rifles. It is an amusing sight, and provokes a smile. Sometimes the leaf carried is twice as long as the ant. I have seen them gathering only one other leaf besides the young pine leaf, namely, from cow wheat (*Melampyrum americanum*). Of this plant they gather also the petals. They make relatively very large cells, of the general shape of a coffee cup, and from two to four inches in diameter. The nests examined were in fine white sand, but the cell walls were made very firm and smooth. In several instances the walls were lined with what may be called a curtain of sand, of different color, the particles of which are held together mysteriously, and the whole suspended against the walls of the cell. This curtain is readily removed, leaving the hard, smooth wall with its original finish, showing clearly that after the formation of the chamber and the completion of the walls, the yellow sand had been brought up from a lower stratum, from two to three feet down, and worked into a loose drapery of hitherto unheard of texture. Dr. McCook assures me that after the pupa state, ants cannot make web. It may be in a sense true, but certainly these ants use a fine white filament, for which I know no other name than web.

The leaf cuttings are manufactured into a porous, spongy material, which becomes crisp when exposed to the air, and in which the young ants are reared. I have usually found this material either on the bottom of the cell or chamber, or else filling the same loosely from top to bottom. I was not prepared, therefore, for what met my eyes in the last chamber examined. Cutting away the side cautiously, I gained a view that surprised me beyond expression. I could have doubted my own eyes, if such a thing were possible. The material described above, made of leaves and other matter, was suspended from the roof of a cell three and a half inches high and wide, extending nearly to the pebble-covered floor. The arrangement was like that of the comb in a beehive. There were three combs, or layers, each shorter than that by its side. These were full of small, irregular

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pockets, so made as to take advantage of all the material used, but not evenly arranged side by side. Each pocket had been completed by itself and without reference to those about it. They were designed for the young ants, but in this case were empty. I am persuaded that this comb, if I may so call it, is made of the partially masticated cuttings bound together with web-like filaments. Washing a little of it in alcohol and placing it under the glass, I distinctly saw white web completely covering some of the particles.—*American Entomologist.*

New Phototype Process.

At the last meeting in Paris of the Society for the Encouragement of National Industry, a communication was received of a process discovered by M. Lenoir, for producing engraved plates from negatives photographed from nature.

The inventor illustrated his process before the council, preparing plates serving to show different styles of engraving, which were distributed among the audience.

M. Lenoir himself describes his process as follows:

"Until now, in order to obtain these negatives, a print was made in fatty inks by Poitevin's system. An impression was taken upon a sheet of transfer paper, which was placed upon a metal plate; after submitting it to the action of acid, it was inked several times under water. All this was difficult as well as uncertain. I have sought a means of operating directly upon the plate, without inking, and in this manner I set to work:

"I lightly coat a metal plate with albumen mixed with bichromate and carmine; this last is used not only as a dye, but it assists in the lifting of the film, on account of its solubility in ammonia. Gamboge and various resins answer the same purpose almost as well.

"The use of carmine is in the stripping off of the mass, because, the exposure taking place upon the upper surface, the carmine draws the albumen with it, more or less, according to exposure.

"When the film is stripped off, an image remains formed of albumen, in itself unable to resist the action of acids. It must, therefore, be rendered insoluble. There are two ways by which this may be effected; one is to cause the albumen to absorb a solution of gum lac, dissolved in hot water with borax; the other, and that which I prefer, is to plunge the plate, once stripped, in a solution of bichromate of potash, then drying at the heat of about 120°. The albumen has by this means acquired the required resistance to the action of acids. The plate has now to be engraved to give it a grain according to the amount of ink it should take up. Upon the unabsorbent and stripped plate a film is spread, consisting of a solution of bitumen of Judea and turpentine mixed with carbonate of lime. When plunged in acid, carbonic acid is liberated; it forms tiny canals through which the acid attacks the metal more or less quickly, by reason of the thickness of the albumen.

"But if strong acid be employed, the minute canals would be soon destroyed; I therefore use acid liquid composed of water acidulated with nitric and oxalic acids and alum. An oxalate of the metal is then formed on the sides of the canals, and causes them to adhere to the plate. The texture of the etching is more or less fine according to the length of time the albumen is allowed to absorb the acid. Minute hillocks remain in form of microscopical obelisks.

"In this state the plate is finished; it requires only to be dried, and is ready to be printed from immediately. No preliminary preparation is necessary, as the whole operation may be conducted in three hours."

A Railway in the Rocky Mountains.

A correspondent of the Denver *Times*, describing the extension of the Denver and Rio Grande Railway from Conejos westward toward the San Juan country, gives these picturesque bits. He says:

For miles the railway curved among the hills, keeping sight of the plains and catching frequent glimpses of the village. Its innumerable windings along the brows of the hills seemed, in mere wantonness, as loth to abandon so beautiful a region. Almost imperceptibly the foothills changed into mountains and the valleys deepened into cañons, and winding around the point of one of the mountains it found itself overlooking the picturesque valley or cañon of Los Pinos creek. Eastward was the rounded summit of the great mountain of San Antonio; over the nearest height could be seen the top of Sierra Blanca, canopied with perpetual clouds; in front were castellated crags, art-like monuments, and stupendous precipices. Having allured the railway into their awful fastnesses, the mountains seemed determined to baffle its further progress. But it was a strong hearted railway, and, although a little giddy 1,000 feet above the stream, it cuts its way through the crags and among the monuments and bears onward for miles up the valley. A projecting point, too high for a cut and too abrupt for a curve, was overcome by a tunnel. The track layers are now busy at work laying down the steel rail at a point a few miles beyond this tunnel. The grade is nearly completed for many miles further. From the present end of the track for the next four or five miles along the grade, the scenery is unsurpassed by any railroad scenery in North America. Engineers who have traversed every mile of mountain railroad in the Union, assert that it is the finest they have seen. Perched on the dizzy mountain side, at an altitude of 9,5 0 feet above the sea—greater than that of Veta pass—1,000 feet above the valley, with battlemented crags rising 500 or 600 feet above, the beholder is enraptured with the view. At one point the cañon narrows into an awful gorge, apparently but a few yards wide and nearly 1,000 feet in depth, between almost perpendicular walls of granite. Here a high point of granite has to be tunneled, and in this tunnel the rock men are at work drilling and blasting to complete the passage, which is now open to pedestrians. The frequent explosions of the blasts echo and re-echo among the mountains until they die away in the distance. Looking down the valley from the tunnel, the scene is one never to be forgotten. The lofty precipices, the distant heights, the fantastic monuments, the contrast of the rugged crags and the graceful curves of the silvery stream beneath them, the dark green pines interspersed with poplar groves, bright yellow in their autumn foliage, that crown the neighboring summits—height, depth, distance, and color—combine to constitute a landscape that is destined to be painted by thousands of artists, reproduced again and again by photographers, and to adorn the walls of innumerable parlors and galleries of art. Beyond the tunnel for a mile or more the scene is even more picturesque, though of less extent. The traveler looks down into the gorge and sees the stream plunging in a succession of snow-white cascades through narrow cuts between the perpendicular rocks.

Correspondence.

The Expansion of Steam.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN for November 20, 1880, there appears an article referring to my paper in the June number of the *Journal of the Franklin Institute*, in which Prof. R. H. Thurston quotes from a letter from an unnamed correspondent, who asks, "What *is* really the proper point of cut-off in steam engines to give maximum economy in dollars and cents?"

Prof. Thurston himself says, "No *theoretical* determination of the proper point of cut-off has ever been made that is of any service to the engineer."

After first giving the rule for the point of cut-off as $E = \frac{1}{2}\sqrt{P}$, Prof. Thurston quickly invalidates his rule by saying, "Sometimes an engine is found to give maximum economy when expanding fifty per cent more; that is, $E = \frac{3}{4}\sqrt{P}$."

Am I not right in saying that Prof. Thurston is trying to give a definite answer to an indefinite question, and doing some pretty wild guessing in the effort?

"Economy in dollars and cents" covers both economy in the cost of *making* and *running* the engine and *economy of steam.* The article in the *Journal of the Franklin Institute* referred only to *economy of steam.*

It is, I think, acknowledged by all that steam should be used dry or superheated; if steam is not given to the engine in such form proper means should be adopted to make it so. Any attempt to deal with or answer questions referring to ill-devised or imperfect apparatus can only result in failure. It is possible to obtain either dry or superheated steam, and I think I was fully justified in so assuming.

The remaining assumption made was that the curve of expansion of steam is *approximately an equilateral hyperbola.* It was not pretended that it was accurately such a curve.

The precedents both among writers on and practitioners of steam engineering warranting such assumption are too numerous to mention.

The work done by the steam can be divided into two parts: first, that necessary to keep the engine running; and, second, the useful work delivered outside of the engine. These two quantities may bear any ratio to each other, and do vary greatly, "even in two engines built from the same drawings and made from the same patterns."

The user of the steam engine naturally regards the useful work only, but *economy of steam*, considered in itself, does not require a consideration of these two forms of work apart from each other.

If, now, my assumptions that steam can be delivered in a dry or superheated form, and that in being expanded its curve of pressure is *approximately* (that is, with sufficient exactitude for practical purposes) an equilateral hyperbola, then is my result and rule—*that the most economical point of cut-off for a steam engine is that fraction of the stroke determined by dividing the absolute back pressure by the absolute initial pressure*—an unavoidable deduction, and it only remains for the engine builders and experimenters to realize the conditions placed as nearly as possible in order to obtain the greatest possible *economy of steam.* I *do not* say in the cost of building the engine or of keeping it in repair.

I *do not* say that the greatest useful work can be obtained from the engine, but that the total work done by the steam in driving the engine and doing work outside of the engine, will be done with close approximation to the greatest possible economy of steam.

Are the assumptions which I have made so impossible of realization that my "theoretical determination of the proper point of cut-off" will never be "of any service to the engineer"?

It was not many years ago that a distinguished engineer announced that no engine would cut-off economically earlier than one-half the stroke.

Our small high-speeded engines have since demonstrated his error, and also shown that the ratio of the power required to drive the engine to the useful work can be greatly reduced.

While no one is more willing than myself to acknowledge the fact that many results of theoretical investigation cannot at once be realized, I still believe that much room for improvement in the construction of the steam engine remains, and that the road which we must follow will be marked out by theory.

I would ask those who have read my article in the June number, to do me the favor to also read a paper entitled "The Limitations of the Steam Engine," in the August number of the *Journal of the Franklin Institute*, in which will be found a continuation of the discussion.

Regretting that so famous a theorist on the steam engine should have entirely rejected all theory, and requesting as a special favor that you will permit me to be heard in defense of my theories, I am, very respectfully,

WM. D. MARKS, Ph.B., C.E.
Whitney Prof. Dyn. Eng., University of Pennsylvania.

Grape Vine Oil.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of October 16 I find an article on "A New Oil from Grape Vines," in which it is said that M. Laliman, a French savant, has discovered that there can be distilled from American vines an oil having the property of remaining fluid at 8° Fah., while other oils congeal at or above 27½°. The oil is recommended for use in watches, etc.

M. Laliman's alleged discovery has been known for more than a century. As early as 1770 oil was made from grape seeds in Italy and France. In 1800 there was a factory at Olby which had existed from time immemorial. Other factories existed in Bergamo, Italy, in 1770; in Rome and in the vicinity of Ancona before 1782; Naples, 1818; Germany, before 1787.

In the south of France, where the grape-oil industry is carried on, from ten to fifteen per cent of oil is obtained, the oil being better and sweeter than nut oil, and remaining fluid at a lower temperature. It is used in lamps, and gives a bright light, without odor or smoke.

In extracting the oil from the grape kernels, the refuse left after distilling brandy or making verdigris is dried and ground fine in an ordinary mill, the yield of oil being in direct proportion to the fineness of the grinding.

Some manufacturers first press without heat, obtaining about 5 per cent of oil; afterwards the stuff is heated and pressed with a yield of 10 or 15 per cent more oil. The oil is of a light yellow color, and in course of time obtains a density of 0·9202 at 59° Fah., and solidifies at about 3° Fah. M. Laliman errs in recommending this oil for watches, for although it does not congeal so soon as other oils it becomes viscid and rancid when exposed to air. Grape oil saponifies readily, but the soap lacks hardness and density.

Black grapes contain much more oil than white grapes. The kernels of grapes from vines in full vigor yield more oil than those from very young or very old vines. In France the vines of Roussillon, Aude, and Herault give the most oil. In general black grapes produce from 15 to 18 per cent of oil; white grapes, 10 to 14 per cent. It is probable that American vines, especially those of California, yield more oil than French vines. In the south of France 25 pounds of kernels are allowed for 25 gallons of wine. It is easy to estimate the quantity of oil that is annually lost in grape producing countries.

TH. FLEURY,
Directeur de l'Huilerie de Bacalan.
Bordeaux, France, Oct. 22, 1880.

Present Population of the Earth.

Volume VI. of Behm and Wagner's *Bevölkerung der Erde*, just issued, gives a mass of well-digested information on the area and population of the countries of the world. The areas of Europe, Africa, America, Australia, Polynesia, and the Polar regions have been carefully recomputed, and as the results differ in many instances from statements usually found in our handbooks, we give an abstract of these new figures:

	Area in sta. sq. m.	Inhabitants.
Europe (exclusive of Iceland and Novaya Zemyla)	3,749,263	315,929,000
Asia	17,209,806	834,707,000
Africa	11,548,355	205,679,000
America	14,822,471	95,495,500
Australia and Polynesia	3,457,126	4,031,000
Polar regions	1,745,373	82,000
Total	52,532,394	1,455,923,500

If these figures are correct, the ocean covers 144,364,860 square miles, or 73·31 per cent of the earth's surface. The most populous towns in the world are London (3,630,000), Paris (1,988,806), New York (with suburbs, 1,890,000), Canton (1,500,000), Berlin (1,062,008), Vienna (1,020,770).

THE letters patent for the improved nursing bottle illustrated in a recent issue of this paper describes two forms for the body of the bottle, one having an inwardly projecting ridge forming depressions on either side of the bottle, the other with an outwardly projecting ridge forming a central channel for containing the last of the milk, and for receiving the end of the movable tube. In practice the inventor prefers the latter form. The body of the bottle is made in two sections held together when in use by a hard rubber ring. All of the parts, including the nipple, are made with special reference to convenience in use and facility in cleaning. The address of Mr. E. A. Barton, the inventor, is 348 Notre Dame street, Montreal, Canada.

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Disinfection of the Waste Waters of Manufactories.

While the purpose of the usual methods of disinfection is to prevent as much as possible all causes of putrefaction, Dr. Alex. Müller, of Berlin, has received a patent for a method of disinfecting waste waters which is based upon quite a different idea, namely, to cultivate those lower organisms which modern science considers to be causes of fermentation, putrefactive decomposition, etc., and to use them for the precipitation or mineralization of waters by decomposing their organic compounds.

To this end a temperature favorable for the development of such organisms is produced and maintained for a day or two in the waste waters, which are previously freed from substances obnoxious to fungi by means of sedimentation or filtration.

In sugar manufactories the necessary warmth is obtained by means of the condensation waters, in other factories by means of steam or superfluous heat, or if necessary even by heat produced specially for this purpose. Care has to be taken that the heat does not exceed 104° Fah., and a cooling below 73° Fah. may be avoided by covering and surrounding the reservoirs with substances which are bad conductors of heat. All substances that may be obnoxious to the life of the fungi, namely, antiseptic substances, such as tar oil, sulphurous acid, salts of copper, iron, and other heavy metals, must be kept away. Strong acids, as muriatic, sulphuric, or other mineral acids, must be neutralized by means of lime or soda; an excess of caustic alkalies has to be prevented.

A special planting of organisms of fermentation will be necessary only in rare cases. Mostly the numerous germs contained in the atmosphere are sufficient. Otherwise yeast, manured earth, or other germ-containing materials, may be employed. Of organic substances, salts of ammoniac, lime, and phosphorus may be used. Generally the nitrogen of the organic substances in the refuse waters should be reduced to about one per cent.

Such of the fermentation-organisms which during the defecation process have not been sunk into the ground, may be removed by filtration or oxidized by nitrification.

The mechanical and architectural arrangements for this method are very simple. They consist of 3 or 4 basins, each having a depth of at least 3½ to 4 feet, for the digestion and defecation of the waste water. They must be able to hold at least the quantity of sewer water produced during one day, and must be furnished with inlet and outlet pipes, through which the liquids continually stream in and out.

The basins are constructed by excavating the ground, and are covered with a swimming layer of porous substances (straw, chaff, foam, etc.) in order to prevent the refrigeration or evaporation of the liquids. Obnoxious gases of putrefaction and other disagreeable vapors are made harmless by conducting them into a system of drainage tubes, so placed in the ground that they are kept dry, or at least never filled up with water.

The basins are connected with filtration reservoirs (filled with coal, coke dust, sand, or other similar substances), which may be erected at any distance from the factories, and, being able to hold at least fifty times the quantity of the daily waste water, are furnished with drains, which are open on both sides.

The basin or filtration slime produced by this method of disinfection is a valuable manure for agriculture and horticulture, and the drainage water is as clear as the drinking water of most cities and may be used without danger.

Dr. Müller's method is especially well adapted for the disinfection of the very disagreeable waste water of beet-sugar manufactories, and may be also advantageously used in breweries, dyeing establishments, tanneries, etc.

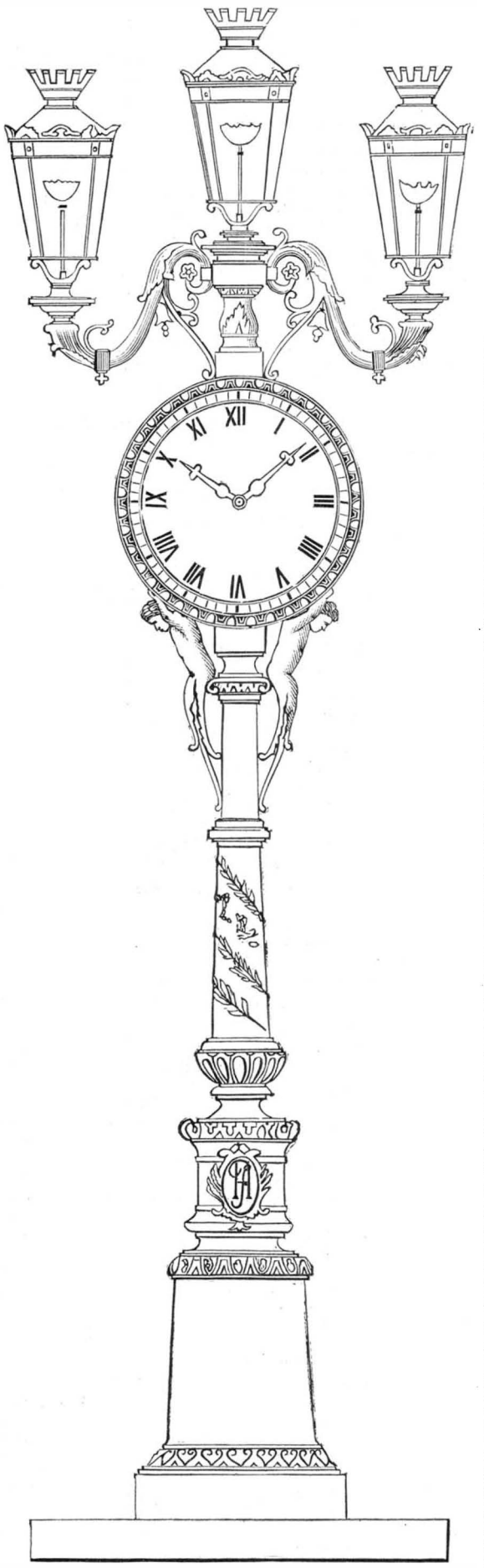
Diamond Mines of India.

A member of the Indian Geological Survey, Mr. V. Ball, says in a recent paper that there are in India three extensive tracts, widely separated from one another, in which the diamond has been found. The most southern of these has long borne a familiar name, which is, however, to a certain extent, a misnomer. There are no diamond mines in Golconda. This name, originally applied to a capital town, now represented by a deserted fort in the neighborhood of Hyderabad, seems to have been used for a whole kingdom; but the town itself was many miles distant from the nearest of the diamond mines, and it was only the mart where the precious stones were bought and sold. The second great tract occupies an immense area between the Mahanunda and the Godavery river; and the third great tract is situated in Bundelcund, near the capital of which, Punnah, some of the principal mines are to be found.

The work of the Geological Survey has demonstrated that the diamonds occur in the Vindhyan rocks of Northern India. In the upper division of this formation there is a group of clay slate (Rewah), and in the lower a group of sandstone (Semri), in both of which diamond-bearing beds are met with. It is still very doubtful, however, if a diamond has yet been found in India in its original matrix. Mr. Ball gives an account of the chief mines, describing in detail, from personal observation, that of Sambalpur, which has now for some time ceased to be productive. The Punnah mines are still productive, yielding a mean annual produce of between $200,000 and $300,000 a year. Europeans have attempted diamond mining in each of these three tracts, but in no instance have their operations been attended with success, and yet there does not appear to be the least ground for supposing that there has been any real exhaustion of the localities where mining is possible.

CHANDELIER CLOCK.

An elegant chandelier clock, in which neither the clock nor the lights predominate to such an extent as to impair the effect of one another, has been in demand for public places; but most of the designs presented were encumbered with defects that rendered them unfit for their purpose. The chandelier represented in the annexed cut is of a very elegant design, and yet is not too elaborate. It may be provided



CHANDELIER CLOCK.

with three lights in one row or with five, of which four rest on arms or brackets surrounding the center light, which rests on the top of the standard. The chandelier is designed to be 17½ feet in height, and to have a dial 3 feet in diameter. The design represented in our engraving is to us ornamental, but a manufacturer would likely change the style and adopt one more or less elaborate to suit the demand. We would suggest to Mr. J. W. Fiske, the extensive manufacturer of ornamental iron work in this city, a trial of the combined clock frame, with gas lights on the same post. They would be especially ornamental and useful in public squares and in front of public buildings.

Electrical Phenomena in Tropical Countries.

In a note addressed to the French Academy (*Comptes Rendus*, p. 446), M. L. Amat calls attention to the fact that the electrical phenomena produced by the friction of the hairy coat of animals acquire a remarkable intensity in tropical countries, especially to the north of the Sahara, toward the 35th degree of latitude. At an altitude of 2,500 to 3,600 feet he found that by passing a comb through the hair of the head or beard, sparks might be produced two or three inches in length. The phenomenon occurred at its best at from 7 to 9 o'clock in the evening, when the weather was warm and dry. In horses the effects are still more marked, and the hairs of their tail stand out from each other so as to form a sort of fan. If the hairs be touched a crackling of the sparks is heard, and at night these are distinctly visible. Sparks are also easily produced by the use of the brush or currycomb. According to M. Amat, the electricity developed in the tail of the horse is positive, as he learned by experiment. Naturally, during rainy or moist weather, the electrical tension is considerably lessened, and it is likewise less sensible in the stable than in the open air. In man the accumulation of the electric fluid is not so great as in the horse, doubtless because he is not so well insulated from the earth as the latter, the horny hoofs of which furnish insulating supports.

Professor Max Muller on Progress.

At the recent opening of the Mason Science College, at Birmingham, Professor Max Muller made the following remarks:

"The spirit in which this college has been founded strikes me as a truly liberal spirit—a spirit of faith in the future, a spirit of confidence in youth. Much as I admire the enlightened generosity of the venerable founder of this college, nothing I admire more than one clause in the statutes, which states that, with the exception of a few fundamental provisions, the trustees not only may, but must from time to time, so change the rules of this institution as to keep it always in harmony with the requirements of the age. You know how other colleges and universities have suffered, have been hampered in their career of usefulness, by the wills of pious and faithful founders and benefactors. Now here, in the founder of this college, we have a truly faithful founder—a man who has proved his faith in the future and his confidence in youth—who is convinced that in the long run the path followed by mankind will be the right path; nay, that those who come after us will be, as they ought to be, wiser and better than ourselves. We who are growing older ourselves know how difficult it sometimes is for an old man to have faith in youth and confidence in the future. Yet that firm faith in youth, that unshaken confidence in the future, seems to me to form the only safe foundation of all science, and on them, as on a corner-stone, every college of science ought to be founded. The professors of a college of science should not be conservative only, satisfied to hand down the stock of knowledge, as they received it, as it were, laid up in a napkin. Professors must try to add something, however little it may be, to the talent they have received; they must not be afraid of what is new, but face every new theory boldly, trying to discover what is good and true in it, and what is not. I know this is sometimes difficult. Young men with their new theories are sometimes very aggravating. But let us be honest. We ourselves have been young and aggravating too, and yet on the whole we seem to have worked in the right direction. Let us hope, therefore, that the professors of this college will always be animated by the spirit of its founder, that they will never lose their faith in progress, never bow before the idol of finality. Let them always keep in the statutes of their own mind that one saving clause in the statutes of this college—to keep pace with the progress of the world. By that clause, by that profession of faith in the future, Sir Josiah Mason has done honor to himself and honor to posterity. Let him rest assured that such faith is never belied, and that rising and coming generations, while applauding his munificence, will honor and cherish his memory for nothing so much as for that one clause, in which he seems to say, like a wise father, 'Children, I trust you.'"

To Get a Large Yield of Rich Milk.

The *Farm*, published in England, confirms our own experience in feeding milch cows with bran. If a large yield of rich milk is desired, says the writer, give your cows, every day, water slightly salted, in which bran has been stirred at the rate of one quart to two gallons of water. You will find, if you have not tried this daily practice, that your cows will give 25 per cent more milk immediately under the effects of it, and will become so accustomed to the diet as to refuse to drink clear water, unless very thirsty.

Prof. J. W. Sanborn, superintendent of the college farm, Hanover, N. H., reports experiments in feeding cows, giving full details of weights of each kind of feed, of milk and butter yield, and the weights of the animals at the beginning and end of each period. In summing up he says: "Meal will make more milk than bran, I no longer hesitate to say. The change in the butter product is remarkable; in changing from meal to bran there was a loss of 17·7 per cent in the butter-producing capacity of milk; in changing from bran to meal there was a gain in the butter-producing capacity of milk of 21·8 per cent." "The results in weighing the cows form an exception to previous experiments, bran and middlings keeping weight better than meal in this experiment. Is it a chance result, asks the professor, or is it due to well defined causes? I will not discuss it, he answers, but observe that it was not at the season of the year when a cow needs a carbonaceous food to maintain animal heat; also the grass of our pasture was browned, and in different condition from June grass or properly cut hay."

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A GREAT PAPER.

We desire to call the attention of our readers to one of the greatest newspapers of the age—one that secures the best writers in this country and Europe, regardless of expense; has the best and fullest book reviews of any paper in the country; has able articles upon financial subjects; has departments devoted to Fine Arts, Biblical Research (something that cannot be found in any other newspaper in the United States), Farm and Garden, Insurance, Weekly Market Reports, Cattle Market, Prices Current, Dry Goods Quotations, etc.--in fact, a newspaper fully suited to the requirements of every family, containing a fund of information which cannot be had in any other shape, and having a wide circulation all over the country and in Europe. We refer to THE INDEPENDENT, of New York. "The largest, the ablest, the best." See advertisement, in another column, and send for specimen copy.

SCIENCE IN AID OF THE HOUSEWIFE.

Mending all kinds of clothing, table and bed linen, etc., and elegant embroidery, is now done on the Wilson Oscillating Shuttle Sewing Machine, without an attachment. Wonders will never cease in this age of progress.

Through a number of years the H. W. Johns M'f'g Co. have established an enviable reputation for making liquid paints that are remarkable for their durability and beauty. Their Asbestos Liquid Paints have real merit, and all who contemplate painting their farm and other buildings should bear this in mind. We can gladly refer the reader to our recommendations of this firm and its paints in the past.—*American Agriculturist, November*, 1880.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Chard's Extra Heavy Machinery Oil.

Chard's Anti-Corrosive Cylinder Oil.

Chard's Patent Lubricene and Gear Grease.

R. J. Chard. Sole Proprietor, 6 Burling Slip, New York.

The Mackinnon Pen or Fluid Pencil. The commercial pen for the age. The only successful reservoir pen in the market. The only pen in the world with a diamond circle around the point. The only reservoir pen supplied with a gravitating valve, others substitute a spring, which soon gets out of order. The only pen accompanied by a written guarantee from the manufacturers. The only pen that will stand the test of time. A history of the Mackinnon Pen and its uses, with prices, etc., free on application. Mackinnon Pen Company, 200 Broadway, New York.

We may look for a long winter. Be sure and see that your roofs are in order. The genuine Asbestos Roof Paints, for restoring and preserving roofs, are strictly first-class articles, and are the cheapest, quality considered, of any in use. The H. W. Johns M'f'g Co., 87 Maiden Lane, New York, are the sole manufacturers.

Among the numerous Mowing Machines now in use, none ranks so high as the Eureka. It does perfect work and gives universal satisfaction. Farmers in want of a mowing machine will consult their best interests by sending for illustrated circular, to Eureka Mower Company, Towanda, Pa.

Wanted—First-class Novelties and New Patents, suitable for city canvassers. Will buy or sell on royalty. Buckeye Novelty Works, 66 Courtlandt St., New York.

OSWEGO STARCH FACTORY, N. Y., Oct. 28, 1878.
H. W. Johns, 87 Maiden Lane.
DEAR SIR. We have several acres of your Asbestos Roofing on our buildings. The first roof, put on fifteen years ago, is in good condition, and we prefer it to any other. Yours respectfully,
T. KINGSFORD & SONS.

Wanted—A Man as Superintendent and Foreman of Machine and Foundry (N. Y. State). Manufacturing a specialty. Good business and mechanical ability required. Giving antecedents, references, and salary desired. Address Iron, P. O. Box 255, New York city.

We recommend Messrs. Boomer & Boschert's Cider Press to every one manufacturing cider or vinegar. The results of the process are wonderful as regards quantity and quality. Send for illustrated catalogue, with prices. Boomer & Boschert, 15 Park Row, N. Y.

For Heavy Punches, Shears, Boiler Shop Rolls, Radial Drills, etc., see illustrated adv. in our last number.

The Inventors Institute, Cooper Union Building, New York. Sales of patent rights negotiated and inventions exhibited for subscribers. Send for circular.

Peerless Colors—For coloring mortar. French, Richards & Co., 410 Callowhill St., Philadelphia, Pa.

The practical printer who penned a pæan to the pen must have had on his mind one of Esterbrook's Falcon Pens, the most popular in use.

Wanted—A Manufacturer of Builders' Hardware to make and introduce a small article. W. J. Decker, 408 West 45th St., New York.

Lenses for Constructing Telescopes, as in SCI. AM. SUPPLEMENT, No. 252, $6.50 per set; postage, 9 cts. The same, with eye piece handsomely mounted in brass, $8.00. McAllister, M'f'g Optician, 49 Nassau St., N. Y.

No. 4 Blaisdell Drill, good as new, Bolt Cutter, several Second-hand Lathes, Engines, and Boilers, for sale by Wm. M. Hawes, Fall River, Mass.

Fragrant Vanity Fair Tobacco and Cigarettes. 7 First Prize Medals—Vienna, 1873; Philadelphia, 1876; Paris 1878, Sydney, 1879—awarded Wm. S. Kimball & Co., Rochester, N. Y.

Superior Malleable Castings at moderate rates of Richard P. Pim, Wilmington, Del.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Jenkins' Patent Gauge Cock; best in use. Illustrated circular free. A. W. Cadman & Co., Pittsburg, Pa.

Wanted—First-class Agents in all Cities to sell Novelties. Will give exclusive right in Cities and States to competent men. Buckeye Novelty Works, 66 Courtlandt St., New York city.

The E. Stebbins Manuf'g Co. (Brightwood, P. O.), Springfield, Mass., are prepared to furnish all kinds of Brass and Composition Castings at short notice; also Babbitt Metal. The quality of the work is what has given this foundry its high reputation. All work guaranteed.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 262 Dover St., Boston, Mass.

The Tools, Fixtures, and Patterns of the Taunton Foundry and Machine Company for sale, by the George Place Machinery Agency, 121 Chambers St., New York.

Improved Rock Drills and Air Compressors. Illustrated catalogues and information gladly furnished. Address Ingersoll Rock Drill Co., 1½ Park Place, N. Y.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Packing once tried always used. Phœnix Packing from 1-16 up in spools or on coils. Phœnix Packing Company, 108 Liberty St., N. Y.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Green River Drilling Machines. See ad. p. 333.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders, and withdraw their illustrated advertisement. Send for their new circulars.

Penfield (Pulley) Blocks, Lockport, N. Y. See ad. p. 348.

Tyson Vase Engine, small motor, 1-33 H. P.; efficient and non-explosive; price $50. See illus. adv., page 348.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co., 52 Dey St., N. Y.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 50 Astor House, N. Y.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 349.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Gun Powder Pile Drivers. Thos. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Light and Fine Machinery to order. Foot Lathe catalogue for stamp. Chase & Woodman, Newark, N. J.

For Separators, Farm & Vertical Engines, see adv. p. 349.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 349.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

For Patent Shapers and Planers, see ills. adv. p. 349.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 349.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Silent Injector, Blower, and Exhauster. See adv. p. 348.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

Pays well on small investments.—Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions and parlor entertainments. Send stamp for 116 page catalogue to McAllister, M'f'g Optician, 49 Nassau St., New York.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 348.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher Schumm & Co., Philadelphia, Pa. Send for circular.

Clark Rubber Wheels adv. See page 317.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

Peck's Patent Drop Press. See adv., page 333.

Reed's Sectional Covering for steam surfaces; any one can apply it; can be removed and replaced without injury. J. A. Locke, Agt., 32 Cortlandt St., N. Y.

For Yale Mills and Engines, see page 316.

Downer's Cleaning and Polishing Oil for bright metals, is the oldest and best in the market. Highly recommended by the New York, Boston, and other Fire Departments throughout the country. For quickness of cleaning and luster produced it has no equal. Sample five gallon can be sent C. O. D. for $8. A. H. Downer, 17 Peck Slip, New York.

Blake "Lion and Eagle" Imp'd Crusher. See p. 333.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Eclipse Portable Engine. See illustrated adv., p. 317.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 349.

For Wood-Working Machinery, see illus. adv. p. 349.

4 to 40 H. P. Steam Engines. See adv. p. 317.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Saw Mill Machinery. Stearns Mfg. Co. See p. 333.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 349.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

50,000 Sawyers wanted to send their full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

NEW BOOKS AND PUBLICATIONS.

ELECTRICITY. By Professor Curt W. Meyer. New York. Paper, pp. 25.

An elementary guide book of practical experiments, prepared to accompany the student's portable electrical machine and apparatus sold by Mr. Meyer. Mr. Meyer is doing good work in preparing for students and schools, at relatively small cost, sets of apparatus for practical experiments in physics and chemistry. The series of experiments described in this pamphlet are such as any bright boy or girl might try and in so doing gain a real knowledge of the fundamental principles of electrical science.

COTTAGE HOSPITALS: THEIR PROGRESS, MANAGEMENT, AND WORK. By Henry C. Burdett. Philadelphia: Presley Blakiston.

A second edition, rewritten and much enlarged, of Mr. Burdett's valuable work on cottage hospitals. His aim has been to embrace everything of importance to the successful management of hospitals and medical institutions having not more than 50 beds. A chapter has been added on cottage hospitals in this country, the number of which is far too few. It is to be hoped that this instructive volume will be the means of their more general adoption in our larger towns and villages.

ANGUS'S PRACTICAL STAIR RAILING. Grand Rapids, Michigan: Charles Angus.

Ten folio plates, scale three inches to the foot, for the use of practical carpenters and joiners who have occasion to construct stair railing.

STRESSES IN BRIDGE AND ROOF TRUSSES, ARCHED RIBS, AND SUSPENSION BRIDGES. By Wm. H. Burr, C.E. New York: John Wiley & Sons. 8vo, pp. 344, xii. plates. $3.50.

A text book prepared for the department of civil engineering at the Rensselaer Polytechnic Institute.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) B. E. N. writes: 1. There is a lightning rod agent about here who claims that his rod will attract at either end and throw the discharge out at the other. Said rod has no ground connections, simply an insulated rod fastened to the ridge of the roof of the building, with bright points at either end. What is it good for? A. Nothing. 2. What per cent of the power could be realized by converting motion from a windmill into air pressure, and using said pressure to run an engine, supposing the windmill to be 6 horse power with 10 mile wind? A. Probably not over 35 to 40 per cent.

(2) H. M. P. asks: 1. What length of stroke I would want on a pump ⅜ inch in diameter, to feed a boiler running an engine of 1½ inch bore, 3 inch stroke, running 200 revolutions per minute at 60 lb. pressure, the pump to work continuously? A. Two inch stroke will be sufficient. 2. Is there any method of bluing or blackening brass so as to resemble the bluing on a rifle barrel? A. Pour muriatic acid over arsenic (arsenious acid), and allow it to dissolve as much as possible of the arsenic; dip the articles in the solution, or rub on the solution with a swab.

(3) W. A. O. writes: I have a portable saw mill. When it was built it had a 16 inch stroke, but for some reason it was changed to an 18 inch stroke, which makes the piston head run within ¼ of an inch of the cylinder head. Will it add or diminish the power to have a new crank and shorten the stroke back to 16 or 17 inches? A. It will diminish the power, if run with the same steam pressure and same velocity. If you wish more clearance, put a joint ring ¼ inch thick, under the cylinder heads.

(4) N. L. asks: 1. How fast will an overshot wheel, 30 feet in diameter, run with one bucket to the foot, each bucket to receive 1 gallon of water? A. May run 4 to 4½ revolutions per minute. 2. What would be its power? A. 2½ to 2¾ horse power. 3. What speed ought a three-foot mill stone to run? A. 180 to 200 revolutions per minute. 4. Will the above wheel run a three foot stone? A. Only about half its proper speed. 5. How many bushels of corn will such a wheel grind per hour? A. Probably not over 1½ bushels.

(5) G. R. asks for information regarding the process of reducing ore by Robertson's method. A. Consult Percy's Metallurgy.

(6) E. M. K. asks: Can you inform me where I can obtain receipts (in printed form) of the most modern and practical methods of nickel plating, as used by those making fine saddlery hardware? A. See SCIENTIFIC AMERICAN, No. 10, Vol. 43, p. 153.

(7) J. W. asks: How many pounds and what size wire should I use in the construction of a dynamo-electric machine, as described in SUPPLEMENT, No. 161, designed especially for practical silver plating? A. The sizes given in the article referred to will be right.

(8) J. J. D. asks for the name of some book on practical distilling and rectifying. A. Byrn's "Practical Distiller;" Duplais's "A Treatise on the Distillation of Alcoholic Liquors, etc." 2. Would a copper shell that could be pushed into the breech of a 32-lb. field cannon with the hands after the first shot is fired be too tight to be pushed in with the hands the second time? A. No. 3. What is used in dying pearl, such as buttons, to fasten the color so as not to polish off in buffing them on a wheel? A. Buff first with a cork and dilute oil of vitriol. Use the coal tar dyes.

(9) J. & J. T. ask for the best known means of preventing paint from lifting off the surface of iron plates. The trouble referred to apparently arises from the spots of rust which lie in the hollow spots on surface of the plates. It seems impossible to clean the hollows. A. Try a little alcoholic shellac before painting.

(10) N. B. writes: I have a smoke stack over my furnace, 20 inches diameter, 30 feet high. Could I get a better draught by letting steam escape through stack? If so, at what distance from the flues must I insert my escape pipe? A. Yes; insert the pipe just above the outlet of the flues, and put an elbow on the end so that the discharge may be directly upward in the center of the stack.

(11) W. J. writes: In looking over my paper of November 13, on page 315, query No. 17, C. D. A. asks where in Michigan an engineer can be examined to obtain a license? In answer, will say at Detroit, Port Huron, and Grand Haven.

(12) S. D. M. writes: 1. I have a small quantity of mercury which is amalgamated with zinc; can I distill it in an ordinary retort (glass)? If not, will you state the best and simplest way. A. No. Use an iron tube closed at the base, and bent so that the closed end may retain the mercury, while the other serves as the beak and condenser; wrap the latter with a wet cloth, which may extend into the basin of water in which the distilled metal will collect. 2. A friend and I have had a discussion and would like you to settle it. Which would be stronger: a sleeve button back hard soldered on a cup shape plate, and the plate soft soldered on the sleeve button, the edges of the plate only having solder; or the back hard soldered on a flat plate and soft soldered on the sleeve button? A. The soft soldered joint would be the strongest in the latter case. 3. What would be the best way of refining, say, 40 dwts. of 12 k. gold to get pure gold and at the same time to recover the silver and copper? A. Melt in a small black lead crucible with about an equal weight of silver (or copper), pour in a thin stream into cold water (to granulate), and boil in pure nitric acid until action ceases. The gold will be found undissolved at the bottom (a brownish black mass or powder). Decant the liquid, wash the residue, and fuse it in a crucible. Precipitate the silver from the liquid by addition of hydrochloric acid, gather it on a filter, wash with hot water, mix with a quantity of dilute sulphuric acid (acid 1, water 5), and add a few strips of zinc. The zinc will dissolve, and the silver be reduced to metallic form. Wash, dry, and fuse the silver sponge. The copper may be obtained from the liquid by adding zinc. As the zinc dissolves the copper is deposited in its place.

(13) J. A. asks: Is there any process known for making black sun prints except by the use of nitrate of silver, or is there any chemical like that used in the cyanotype or blue process that will produce a black instead of blue? A. We know of no simple and satisfactory process. See Vogel's "Chemistry of Light and Photography."

(14) J. P. McD. writes: I have constructed an armature containing about ten pounds of wire, somewhat like Siemens. I was compelled to wrap it tight in order to make the wire lie even. I afterwards varnished the whole with shellac, but I find when I connect the ends of wire to a battery that the circuit is closed no matter what ends are connected. I do not think that any of the wires make direct contact in the coils. The question is, does the current jump across? does it connect by induction? or have I actually wrapped them in contact? Please give me your opinion in the columns of your paper, and likewise inform me if such action will interfere with the working of the machine. Two cells of gravity battery were used in testing. A. It is probable that you have drawn the wire strands so tightly across the iron core as to cut the insulation of the copper wire and make a short circuit through the iron. You should place thick paper or cloth between the copper wire and the core of the armature to prevent accidents of this kind. Your armature is useless in its present state.

(15) R. S. writes: In the article on "Spurious Indian Relics," in the SCIENTIFIC AMERICAN of the 16th of October, you allude to an announcement by some Western journal, of the finding of a fine specimen of the discoidal stone," and you say you are inclined to believe of such stones, like Professor Cox of Indiana, that they are simply "a natural production, a piece of waterworn rock, made smooth by continual rollings." I know of a number of these discoidal stones in this part of the country. I have had several, and now have two as fine specimens as I have seen, made of nearly white quartz, translucent, highly polished, smooth as glass, and seemingly as symmetrical and true as a piece of wood can be formed in the lathe of the present day. I have one or two unfinished ones, made of coarse granite, with no attempt at making them circular, but with saucer like cavities on both sides of the stone. I believe the most skeptical would be convinced on examining these discoids, that they are not "natural pro-

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ductions," but are the product of skilled "human workmanship." There is no difficulty in perceiving a striking difference between a flint implement or arrow head and a splinter of quartz.

(16) H. C. W. asks: 1. If an engine of 100 horse power propels a boat 5 miles per hour, will an engine of 200 horse power double or quadruple the speed? A. The power required is as the cube of the speed. It would require 8 times the power for 10 miles per hour, that would be necessary for 5 miles. 2. If two cannon balls, one weighing 8 and the other 2 pounds, be fired with the same velocity, which will go the further? A. The larger one.

(17) W. E. writes: 1. I have a lot of grapes that I want to keep on the stems until the middle of the winter. How can I do it? A. Dip the ends of the stems in melted paraffine and pack the bunches in tight boxes, with or without a packing of cotton. 2. Can you refer me to any paper that has an article on hammering saws? A. See SCIENTIFIC AMERICAN, Vol. 36, page 259.

(18) T. B. asks: What is spelter composed of? Dictionary says, an impure zinc. Is that the same as the spelter commonly sold in the stores for brazing purposes? A. No. Spelter for brazing copper and iron is composed of copper 1 part, zinc 3 parts. Melt the copper, then add the zinc. When the alloy has cooled sufficiently to become solid, pulverize coarsely in an iron mortar.

(19) C. E. B. asks: 1. How can I put a hole through the bottom of a glass bottle? A. By means of a very hard drill wet with turpentine. 2. Will a wooden rod coated with shellac varnish make a good insulator? A. It will answer for some purposes, but is not so good as glass. 3. In making the resinous cake for an electrophorma I find the resin (when used alone) to be too brittle. Can you tell me of anything that I can mix with the resin so as to obviate the above difficulty? A. Use a mixture consisting of shellac 5 parts, wax 1 part, pitch 1 part. 4. In making a Leyden jar, with what is the tin foil put on? A. Shellac varnish. 5. It is a very difficult matter to put the tin foil on the inside of a Leyden jar. Can you give me directions for anything else that I could put on with less difficulty? A. You may fill your jar half full of crumpled pieces of tin foil.

(20) J. H. S. writes: I am using a gelatine copying pad which I have made myself. I find it very useful, but experience some trouble in washing the ink off. Can you tell me of some method which will take the ink off easily? A. If you allow the ink to remain it will be absorbed in a few hours so that it will not print. This renders it unnecessary to wash the pad.

(21) F. H. S. asks: 1. Which has the most power, pressure of steam being equal and cylinder the same size, an oscillating or ordinary eccentric engine? A. Practically there is scarcely any difference. 2. Can you also refer me to any number of the SCIENTIFIC AMERICAN which contains plain directions for making either kind, that a good mechanic could follow? A. There are no such instructions published in the SCIENTIFIC AMERICAN, nor can you find them published, except perhaps scattered through a number of books.

(22) R. A. R. writes: I see mention made of graphite as a lubricant. Is it, as is claimed, far superior to oil as a lubricant and a remedy for hot journals, friction between wearing parts of a machine, etc.? Is it what it is claimed to be? A. Graphite, or black lead, has long been used with oil as a lubricant, in troublesome cases, but care must be taken that the graphite is clean and fine, otherwise it will not answer well.

(23) W. E. C. asks: Can you give me the rule to find the vertical height of a ball governor, the number of revolutions being given? I am thinking of making a different governor for our engine. The present one runs 56 revolutions, and the vertical height is 16 inches. According to the rule $\left(\frac{188}{\text{revolutions}}\right)^2 =$ height—the height is only 11·22 inches. I want to run the new one 78 revolutions, but this rule don't appear a safe one. A. Your rule appears to be correct. Another method is to calculate the number of vibrations of a pendulum of the given length, the revolutions of a governor will be half the number of vibrations.

(24) R. L. S. writes: In a late work on philosophy I notice the author makes a difference between "momentum" and "striking force." He says momentum "is equal to the weight of the body multiplied by its velocity per second expressed in feet," and that the "striking force of a body is equal to its weight multiplied by the square of its velocity." Example: A bullet weighing two ounces, fired with a velocity of 1,400 feet per second, would strike with a force of 245,000 pounds. Is there any difference between momentum and striking force? Please explain. A. Momentum means the mechanical effect which a body in motion will produce in a moment (second) of time, and is as the weight multiplied by its velocity. "Striking force,"—"Force of Impact," and "Vis Viva"—all these terms mean the same thing; the whole mechanical effect which a body in motion will produce in being brought to rest, no regard being had to the time in which the effect is produced, and is as the weight multiplied by the square of its velocity.

(25) A. D. asks: What sort of hose, rubber, cotton, linen, etc., is most durable for country use with lawn sprinklers, etc., the size being 1½ inch? A. Cotton or linen; but it must be carefully drained and dried after use; but if this cannot be done, then "carbolized" rubber hose is to be preferred.

(26) C. M. D. writes: Yesterday I watched the engineer while boiler-cleaning, and find on the bottom of shell there had formed scale. This was broken up in small pieces and left the iron voluntarily. All did not come off, and the thickness varied. I have never tried any of the compounds advertised to prevent scale; have always been warned against them. Some say that potatoes are a preventive or loosener, some say crude oil. One remedy suggested by one of the best machinists in the city was to blow out, half way down, twice a week. Now please give me your idea of the last-named preventive and such other information as you think will be beneficial. A. The blowing down is good; only instead of blowing half way down twice a week, blow down two inches once a day. Potatoes in small quantity are good, so also is a small quantity of crude petroleum oil.

(27) G. S. C. asks: Can you tell me the cause of the Indian summer haze, so frequently remarked? A. Mainly due to vapors rising from decaying (fermenting) leaves, recently fallen; partly to smoke from burning leaves, swamp grasses, prairie fires, etc.

(28) E. L. asks: 1. Can water through heavy pressure in a heater get above 212° Fah.? A. Yes. 2. How is the best tailor's chalk made? A. It is a natural mineral (talc).

(29) W. E. P. asks: 1. How fast should the teeth of a circular saw run in sawing hard wood into lumber, to get the best effect of the steam? A. 8,000 to 9,000 feet per minute. 2. How fast should a pair of 30 inch underrunner burrs run in grinding corn? A. About 260 revolutions per minute. 3. What is the practical difference between hemp and ring packing for cylinders? A. Ring or metallic packing has less friction and will keep tight much longer. 4. How are 2x4 inch engines packed? A. Best packed with metallic rings.

(30) J. S. N. asks: 1. What is the least depth that paddle wheels should be immersed in water to work well on a boat 20 inches deep? A. Should not dip less than 6 to 8 inches. 2. Should I have 4 or 6 buckets, if I make 100 revolutions per minute? A. Should have a sufficient number that at least one bucket has constantly full dip. You cannot work successfully at 100 revolutions per minute with a paddle-wheel.

(31) E. W. asks for a recipe for ebonizing wood. A. Apple, pear, and walnut, if fine grained, may be ebonized by the following process: Boil in a glazed or enameled iron vessel with water, 4 oz. of ground gallnuts, 1 oz of logwood chips, and ½ oz. each of green vitriol and crystals of verdigris. Filter while warm, and brush the wood over with this repeatedly. Dry and brush over with strong cold solution of acetate of iron and dry. Repeat this several times, and finally dry in an oven at a moderate temperature, and oil or varnish.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. H.—Scales of mica and carbonate of lime.—W. W. A.—Not a petrifact—but partially altered hornblende.—C. H. C.—It is hornblendic rock.—F. D. H.—Hornblende.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

November 2, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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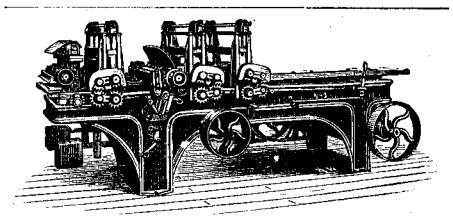

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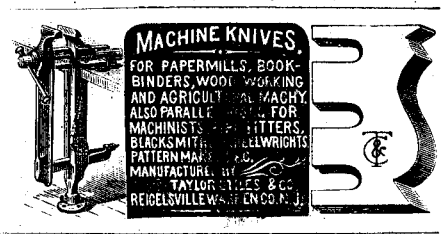
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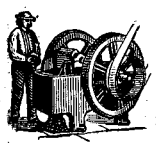

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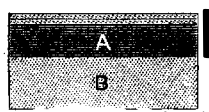

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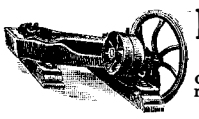

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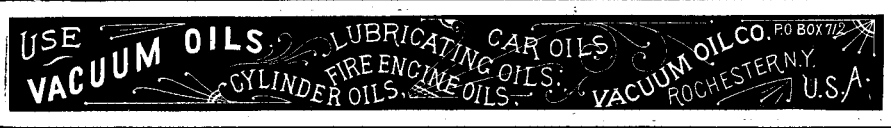

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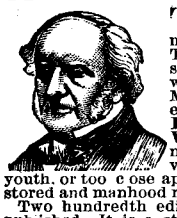

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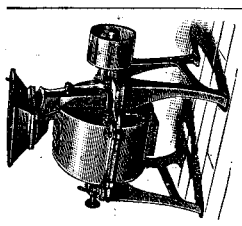

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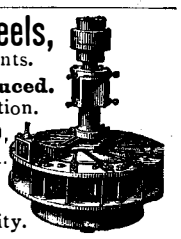

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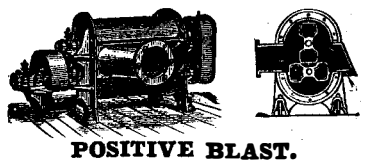

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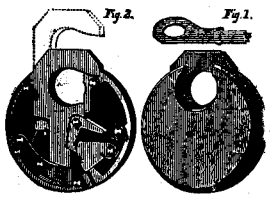

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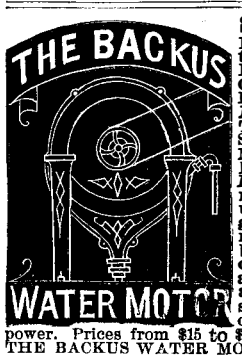

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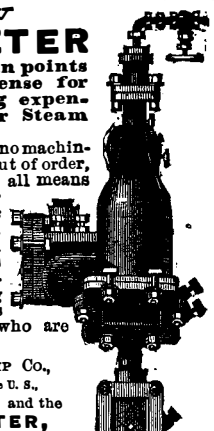

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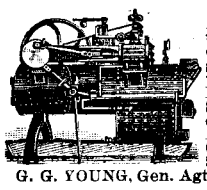
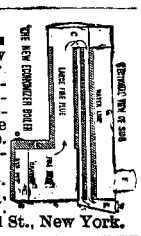

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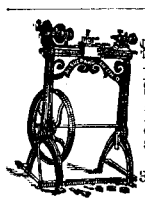

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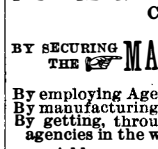

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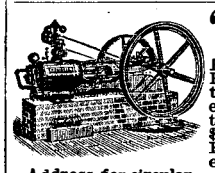

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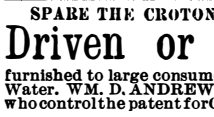

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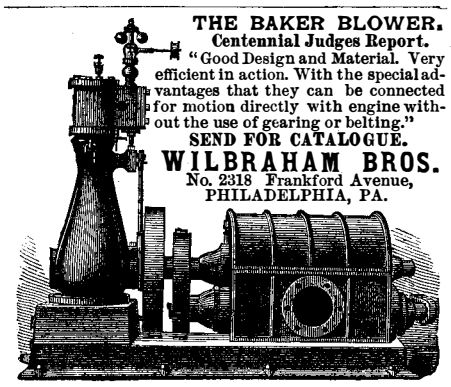

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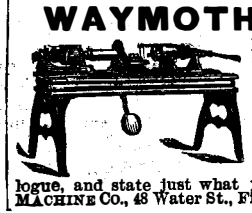
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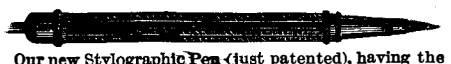

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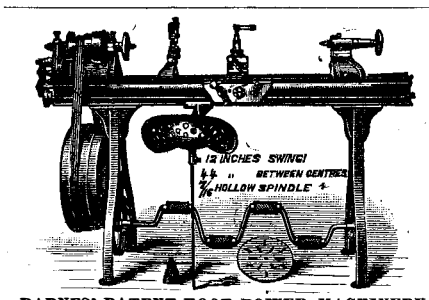

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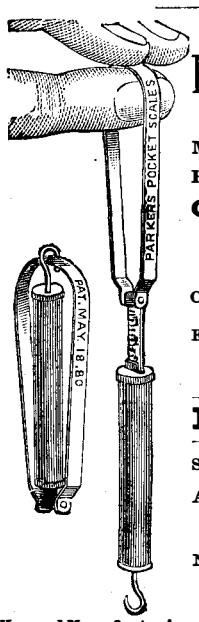

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